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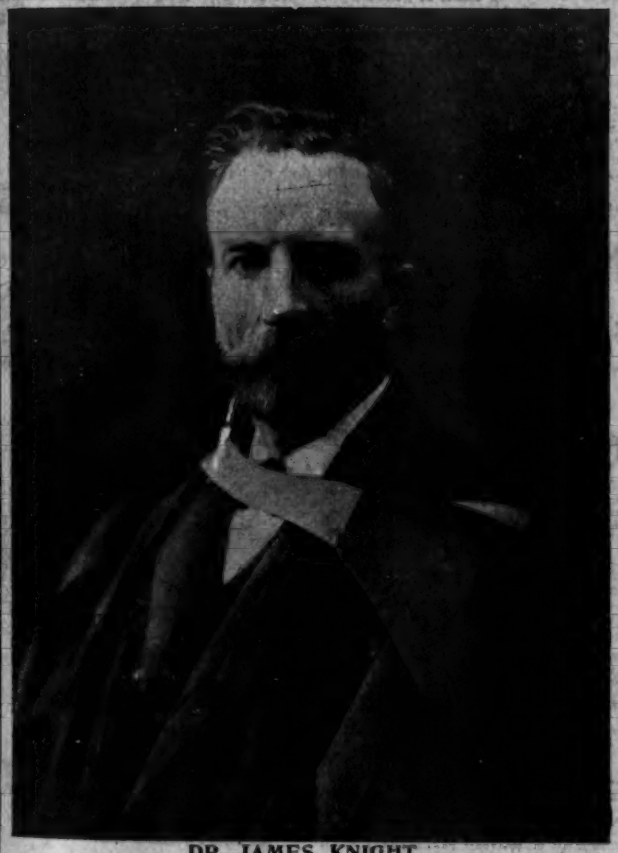
THE PRACTICAL TEACHER



DR. JAMES KNIGHT,
Headmaster, St. James's Public School, Glasgow.

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VOL. XXIV No. 8

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THE
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A MONTHLY MAGAZINE AND REVIEW

FOR THE SCHOOL-ROOM AND THE STUDY

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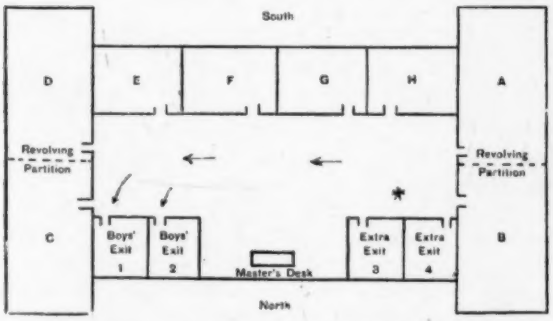
FIRE-DRILL FOR SCHOOLS.

TILL the recent fire at the Shaftesbury Road Schools, East Ham, there had been so long an immunity from such a danger that the public, as well as teachers, had come to regard a "fire" in school during working hours as almost outside the pale of things worth careful consideration.

As if to justify the doctrine of chances, or Hamlet's dictum, "When troubles come, they come not single spies but whole battalions," straight on the heels of East Ham came the Glasgow fire, while the new year has one to report from Toronto.

In every case the coolness and promptitude of the teachers have avoided a panic and all the dangers involved in it; but both of the British cases show that we can no longer ignore the question of some sort of "emergency" drill. This is needed in every school, for in the school at East Ham, which is one of the very



latest type, there was only some six minutes between the first warning and the collapse of the roof; and if such drill be needed in schools of the newest kind, it needs no argument to show its imperativeness in schools of older type, and especially in those with bad or an insufficient number of exits.

A plan (not drawn to scale) is given of the boys' floor at Shaftesbury Road; and as this is the third story, one has only to think of the panic in theatres to realise what might have occurred, spite of the four exits, had coolness or good discipline been lacking.

Mr. E. Richardson, the head-master at Shaftesbury Road, had adopted the following "emergency" drill to meet the possible risks of damage from lightning, as the school stands high above surrounding buildings, and is somewhat exposed. At a given signal—in this particular case an old-fashioned policeman's rattle was used—loud enough to be heard by the whole (boys') school, every teacher immediately stops work; the order

Interior of Hall before Fire (taken 1902).

is given to "stand," "out," "march;" and then each teacher sees his children out of the classroom into the hall. Then the teacher moves to the staircases, and the children march down. *That is the whole drill;* but beneath it lie the absolute and unquestioning obedience of the children, and the perfect loyalty of the staff.

The star in the plan indicates where—*in the ceiling*—the fire was first discovered; and as the boys in class-

rooms marked A and B were in greatest danger, they were the first to be marched out of their rooms. The

HALL, LOOKING TOWARDS EAST.

arrows show the rest of their course to the exits marked 1 and 2 respectively. The exits 3 and 4 could have been used, but as the staircases to which they lead were being used by the girls at that time, it was thought best to dismiss the boys by the two empty staircases.

HALL, LOOKING TOWARDS WEST.

If, however, from some cause it had been impossible or inadvisable to use the exits 1 and 2, then the exits 3 and 4 would have been requisitioned.

It is impossible to give a drill to suit every school. So much depends on the local circumstances—the staff, arrangement of classrooms, number of exits, etc.—that each head-teacher can best devise the drill to suit his (or her) special case. The great thing is *to be prepared*—"the readiness is all"—and the preparation can only come from practice. Regular practice is necessary; for if such drill comes only once a term, it may easily be forgotten, while too frequent repetition of it may lead to laxity. The form as well as the frequency of the drill must be left to each head-teacher's discretion. With the requisite preparation, the children go through the drill without panic or even flurry, and at East Ham hardly any of the children knew that it was an actual fire. Indeed one little man complained that he did not take his coat, although he passed it, because he thought he was coming back. Over 2,000 children were got out unhurt; and when one learns that 639 came down from the top floor within five minutes, one may feel proud to belong to a profession that can discipline young England in such splendid fashion.

A CHRISTMAS LETTER.

FOR the benefit of as many of our readers as have not seen a copy, we have much pleasure in publishing Mr. Hayward's tenth Christmas letter to his scholars. Mr. Hayward is the head-master of the Council Schools, Somerville Road, Birmingham, and every Christmas since and including 1894 he has adopted the plan of issuing on a neat letter-card a Christmas and New-Year's wish to his boys and girls, instead of giving them a greeting in the usual and ordinary fashion. The letter is written in an easy style, so as to make it suitable for and intelligible to the youngest child in the school. The tone of Mr. Hayward's school is admitted to be exceedingly healthy, and we have no doubt the issue of his Christmas letters has been one of the means of producing it. The following is the text of the letter:—

"32 TENNYSON ROAD, SMALL HEATH.

"MY DEAR SCHOLAR,—When you read this letter another Christmas morn will have shed its light on your home. In the midst of your friends, while you are thinking of those who are away and cannot come, I greet you once again.

"A happy Christmas Day!

"'Tis the day of peace! From the abode of light and love, of joy and song, the angels came long, long ago and sang a song on earth. The words we know: 'Peace to all, to all goodwill.' The music, alas! is lost, and will never here be heard. Could we but sing the song to the old, old tune how glad the world would be!

"A happy New Year!

"With all my heart I hope the New Year will be a bright one for you—every day of it, every moment. Use the days as they come well. Be busy at right times, and take your rest in mirth, in fun, in what will bring no pain to you or any other of God's gifts to earth—the birds, and all that live. Be dull—never. Be idle—never. And may the peace of mind that comes to him, to her, who does right, or tries to do it, ever come to you.

"Believe me to be your very affectionate master and friend,

"CHAS. F. HAYWARD.

"*Christmas Eve, 1903.*"

PRIZE COMPETITION.

This Prize has been awarded to "SNOWFLAKES," sent in by "'Appy 'Ampstead."

Will winner please send in his name and address to

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BRITISH MUSEUM

BY MANY HANDS.

"Quot homines, tot sententiæ."

EXPERIMENTS on child study are proceeding apace, but will our children come out of the experiments better than they go in? A lecture on the subject of "Child Study" was given in the Lecture Hall of the Sunday-School Union on January 5th. In illustration of the influence of "suggestion" on children, the lecturer stated that "a teacher talked to the children of various perfumes, and then said *he would spray some* about the room. He sprayed pure water in the room, and 95 per cent. of the children, seven years of age, declared that they smelt perfume. With the elder children the number lessened, and only 50 per cent. of the children, ten years old, thought they smelt perfume. Another experiment was tried. Bitter quinine was talked about, and *the children were told that some would be dropped on their tongues.* Pure water was given them, but of 288 children 218 said it had a bitter taste." Now, what do these experiments show? In the first place, they show the implicit confidence that little children place in a statement by their teachers. This confidence a teacher is bound to consider it to be his most sacred duty to retain, and should never depart from the path of strict truth in dealing with his pupils. When a teacher deliberately says "the thing which is not," and deceives little children in the way described above, and offends the sense of truth in one of the little ones, it were surely better that a millstone were hanged about his neck, and that he were cast into the sea, than that he should be allowed to pose as a student of child nature. With the value of "suggestion" in teaching all will agree, but legitimate suggestion consists in offering one idea with which a child is either already familiar, or which he will grasp easily, so as to lead him to form ideas which would otherwise present difficulties. It certainly does not consist in asking him to accept statements which are absolutely devoid of truth. If children are treated in this way, we are not surprised that the percentage of those who accepted the teacher's word fell to 50 among those who were "more than seven." It is a wonder that it was so high; and certainly if children once get to know that they have been deceived, they will refuse to believe their teachers even when they are speaking the truth.

IN the babel of tongues that make up the British Empire we at the "Hub" take the smallest part—a mercy for which teachers are not sufficiently thankful. The report of the Lieutenant-Governor of the island of Malta, just published, throws a little light on the confusion of tongues that goes on at the fringe of the empire. Last year it appears 8,327 Maltese parents exercised the option of selecting the language of colloquial instruction for all their Maltese young hopefuls attending school in the first four standards. Think of it, ye British teachers! Figure to yourselves your time-table, showing provision for instruction in two, possibly three, languages, with a relapse, we suppose, into *lingua franca* in the case of the incorrigibly backward; and then let your grateful thanks arise that you have been spared this variety of occupation. Now if Esperanto were a perfected fact, what an opportunity for Malta! We commend its case to the council of the Esperanto propaganda.

British Babel.

THE figures from the report are striking. Out of these parents 81·4 per cent. opted for English, 18·6 per cent. for Italian. The boot was on the other leg when the young Maltese emerged from the chrysalis stage of the fourth standard. Then 30·7 per cent. elected for English, 68·7 per cent. for English *and* Italian, ·06 per cent. for Italian only. When looked at closely these figures bear out in a curious way the conclusions of modern language teaching. Below the fourth standard the bulk of the parents chose a foreign tongue as the *colloquial* instrument, just at the time when the speech centres of a child are developing and the verbal memory is most tenacious. Then (assuming that the age of pupils in the various standards is approximately the same in Malta and England) towards the age of eleven or twelve years the majority add another language, just at the age which is found to be the best for the beginning of a second tongue by those who have hitherto been accustomed to a single one. Oddly enough, a somewhat similar option allowed to university students—that of choosing the language of their examination—shows precisely opposite results. Few chose English; nearly every one selected Italian, which, seeing the classes from which the school children and students are respectively drawn, as a Frenchman would say, "gives furiously to think."

Some Figures thereon.

SPEAKING of tongues reminds us that Professor Sadler has been talking to the Modern Language Association on "the influence of the educational writings of Herbert Spencer," with special reference to the aims of the association. Though the address was an excellent commentary on Spencer's book, it had little to do with modern languages. We should have said that Herbert Spencer's work would make a splendid battlefield for the humanists *v.* scientists, but that it would offer little scope for the advocate of modern tongues; and, judging from the report, that is precisely what Professor Sadler discovered. His eloquent appeal for a form of education which shall embrace three disciplines—of the bodily powers, of letters, and of science—reads much like one trying to hold the balance between the ancients and the moderns. But the Modern Language Association comes in only as an afterthought.

Spencer, Sadler, and Tongues.

AS seems inevitable in an educational address, much of the criticism turned round Spencer's definition of education. Has anybody ever stopped to think what a plethora of definitions of education we possess? And the worst of it is that everybody who deigns to twitter on this omnipresent topic instantly furnishes a new one—by way, we suppose, of submitting his or her qualification to twitter. If we wished to single out any one from the rag-bag of definitions about education in general which pleases us more than another, let it be the one

About Definitions.

which Anatole France puts into the mouth of the aged Sylvestre Bonnard in his delightful book, *Le Crime de Sylvestre Bonnard*. It is too long to quote in its entirety, but the opening is altogether admirable. We translate freely.

> LAWYER MOUCHE.—One doesn't learn by amusing oneself.
>
> SYLVESTRE BONNARD.—On the contrary, one *only* learns by amusing oneself. The art of teaching is only the art of awakening the curiosity of young minds in order afterwards to satisfy it, and curiosity is lively and healthy only in happy minds. The information one stuffs by force into others' minds chokes and stifles them. To digest knowledge you must have swallowed it with appetite.

There, it seems to us, is something on which humanists and scientists, ancients and moderns, can all agree.

* * *

The Mosely Travelling Commissioners.

THE Mosely Educational Explorers are returning from the scene of their explorations, and at once, the spigot of enthusiasm being loosened, the stream of small talk descends. It is to be hoped that the enthusiasm of individual members is not going to discount the value of the report we all expect—a report containing the solid, concentrated sense of the commissioners, a veritable mine of expert experience. Naturally enough specific characteristics appeal to specific individuals, but we await the precipitated wisdom of the whole company, where these special appeals will tend to balance one another. The Rev. A. W. Jephson is struck by the development of the high schools, the grades above the primary. In this latter section (the primary) he thinks London, as represented by its School Board, has little to learn from the United States—a piece of information which should fall gratefully on many ears, in spite of the fateful day fast approaching. The university system with its free education, the evening schools, vacation schools, the free lectures of New York, fill him with admiration; but especially is he struck by the swift Americanisation of the foreigner which takes place in the schools. Exactly! It is the formative influence of the school which makes, and has always made, the fight for it so bitter.

* * *

The School Deambulatory.

THE school omnibus we are acquainted with. It is an accepted institution in some of the rural districts of the United States, and performs a useful work. By collecting scattered children and bringing them to a central school, it makes possible one fully-equipped, efficient school in a sparsely-populated district instead of several ill-supplied, inefficient ones. But the school which goes on tour is a novelty, and it has remained for Cuba to introduce it. In the interior of the island the *haciendas* or farms are so scattered that parents will not allow their youngsters to make the journey to school. Since Mohammed will not go to the mountain, the mountain must come to Mohammed. A tent, seats, desks, maps, blackboards—in a word, all the strictly necessary—are packed up in a bullock-wagon, and *voilà!* the school deambulatory. The staff consists of a teacher, plus a wagoner, who doubles the parts of school porter and cook with that of *arriero*. Cook, say you? Yes, cook. For fees are paid sometimes in kind. And pupils and dominie must eat, even though school-keeping and school-going partake of the nature of an eternal picnic. And Master Jack-o'-all-trades, the *arriero-portero-cocinero*, has to look after the material wants of bipeds as well as quadrupeds.

* * *

Where Walking is not a Craze.

AT least so says the *Memoria de Escuelat Publicas*, which is the title of the official report of the provincial superintendents of Cuban education. The same report contains another illuminating entry. It has to do with the indolence of the Creole. On the subject of disinclination to exertion a good deal might be said on the European Spaniard, who, in the southern provinces of the Peninsula, might be described as a professor of masterly inaction. We ourselves have seen him recline at full length on the ground for a whole day, stirring only when trodden on, or when his faithful moiety brought him food. Evidently this dislike of movement becomes accentuated, if that be possible, when Spanish and American blood become mixed. At any rate the *Memoria* complains of the dislike of walking which characterises the Cuban, and draws a doleful picture of the attendance at school when any accident of weather provides an excuse for avoiding the daily walk. Rain or heat are equally effective as preventives. But the record is surely provided by a day of heavy rain, which, we are assured, made a clean sweep of the attendance in nine schools out of twelve in one of the chief towns. Talk about the "school attendance problem" in England! Compared with Cuba, it doesn't exist. Supposing that the English climate for the year just closed had been transferred to Cuba, what would have been the percentage of attendance for the year?

* * *

The School Propagandist.

TO parody a celebrated exclamation, "*La tuberculose voilà l'ennemi!*" For in most countries extraordinary efforts are being made to stamp out this scourge. On the same lines comes a proposal by a French professor to establish a society for saving children from consumption. His project is to take from families known to be tuberculous those children who have escaped the contagion, and after medical examination to board them out in families in the country to be reared and educated. He wishes to act by prevention, and there is little doubt that some such action would do a great deal towards stopping the ravages of this dreadful disease. But with the growth of regulations for isolation, notification, compulsory sanitation, and the penalties attaching to them, we are fast approaching the condition of the people in *Erewhon*—Mr. Butler's fantastic satire on modern life. There disease was treated as crime, and the adventurer's first shock came from seeing an Erewhonian, charged with being guilty of consumption, convicted and sentenced to perpetual imprisonment. At any rate, in France a most determined propaganda against this enemy is being carried on, and it figures largely in the schools. Never a week passes but some new pronouncement is made in connection with anti-tuberculous instruction, or that other "anti"—the anti-alcoholic instruction.

* * *

SPEAKING of *Erewhon* reminds us that a new edition has appeared of this famous book. One section of it has a great interest for teachers, especially

A Satirical View of the Classics.

at a time when, like the present, the terms humanistic and scientific are being bandied about. It describes the adventurer's excursion to the colleges of Unreason, the great university of the Erewhonians, where he finds a specious system of education in vogue whose description is a delightful satire on the classical education of the older English universities. He pokes subtle fun at the engrossing study of "hypothetics" and of "the hypothetical language," to which the Erewhonians were addicted; and, as is usual in really good satire, there is much sharp criticism hidden therein. The arguments of the Venerable Professor of Worldly Wisdom on this "hypothetic" study are amusing, but they make the reader think. The clinchers adduced by this venerable teacher, who was also President of the Society for the Suppression of Useless Knowledge and for the Completer Obliteration of the Past, are but slender travesties of arguments adduced in all seriousness by living partisans of the "hypothetical" language study—that is, classics. For sound sense conveyed in fun, our readers cannot do better than read once again *Erewhon*.

THE typewriter has almost killed caligraphy—the art which won Roger Ascham an appointment at the court of Elizabeth of glorious memory. Is the telephone to kill our mother tongue, and convert "the well of English undefiled" into a stream of cacophony? The instrument has a curious way of distorting sounds, but the following conversation (which comes, by the way, from Chicago) owes as much to slipshod talk as to the erratic telephone.

English by Electricity.

Two ladies of the telephone discourse:—

"H'lo!"

"H'lo!"

"Thatchoo, Pim?"

"Yeh. Hoozat?"

"Smee—Nell."

"H'lo, Nell! Smatter?"

"Nothin'. Thought 'd call yup. Say, Pim, juno Tom Dixon?"

"No. Oozee?"

"Letcha know some time. Say, jeerabout Kitten Jim?"

"No. Whajjaknow 'bout 'em?"

"Don't speak teach other."

"Wot strubble?"

"Ida know. Cumminover soon?"

"Yeh. Guesso. B' choor cumminover tower house first."

"Wilifican. Gotteny fudges?"

"Lot zuvvem."

"Well, I'll come. G'by!"

"G'by! Say!"

"Well?"

"Don't tell wattitoldjuhbout Kitten Jim."

"I won't. G'by!"

"G'by!"

Shade of Sam Johnson! That his rounded periods and sesquipedalian terms should suffer this barbarous clipping and swallowing! It is enough to make the doctor attack the Telephone Exchange and damage all the connections. What a difference there is, too, between a child's enunciation in the reading lesson and in his ordinary conversation! We sometimes wonder whether our teaching produces any real effect.

N.U.T. NOTES.

IN October's opening days it was my good fortune to stand on the Waterloo platform, and wish *bon voyage* to Mr. Harry Coward, *en route* for America with the Mosely Commission. It was remarked, at the moment, that he seemed to have present more intimate personal friends than all the rest of the Commissioners put together; and his doings and writings, as recorded in the "Organ of the Union," have been followed with close interest by all lovers of education. On his return to England, on the eve of an Executive meeting, the gentlemen whose metropolitan headquarters are the Bedford Head Hotel improvised a smoking concert in his honour, and this was extremely well attended. It was, however, but a prelude to better things; for at the New Year's Executive meeting a little dinner, quite *en famille*, and confined to past and present members of the Executive, and the Union's chief officials, was held at the same hostelry. To my infinite regret, a prior engagement prevented my testifying, personally, my esteem and admiration to the president. But from all quarters I heard that the fifty ladies and gentlemen able to be present had a thoroughly good time, and that Mr. Coward had a fine reception on rising to respond to the toast of "our guest." His speech was naturally devoted to American educational affairs, and his own particular portion of the Mosely Report will doubtless be a weighty and illuminating one. Miss Broome, Messrs. Crook, Cullum, John, Kelly, Macnamara, and Sykes all contributed songs. The "hit" of the evening came, however, by general consent, from Mr. A. S. Caudle, who gave some fancied experiences, in the style of his famous namesake, immortalised by Douglas Jerrold. Mr. Butland made an admirable secretary to the dinner.

The President's Home-Coming.

NO man at Russell Square is more generally popular than the genial G. J. Rankilor. He returned to the Executive at a time when the relations between the "Board" and "Voluntary" teachers were occasionally somewhat "strained," and, by the exercise of much commonsense, unfailing good temper, and great tact, was able to convince his "Voluntary" colleagues that their interests and those of the "Board" teachers were identical. It will be remembered that whilst representing the Union at a congress of teachers in the north of France, he met with a carriage accident, which practically rendered him *hors de combat* for nearly six months. His reappearance at the January Executive meeting was greeted with loud applause, and the president's eloquent and sincere words of welcome to him found a ready echo in every heart. Mr. Rankilor, in reply, said, amongst other things, that the universal kindness he had experienced at every hand, from the president and Mr. Hole (his *compagnon de voyage*) downwards, made him almost forget the accident and the pains he had endured. I trust it will be long before we lose the benefit of his ripe experience, sound judgment, and ever-youthful enthusiasm at the Executive Board.

Mr. Rankilor's Return.

MONTH by month in these "Notes" reference has been made to the beneficent work of the Teachers'

Benevolent and Orphan Fund, and to the ever-increasing needs of the suffering and distressed, the widows and the fatherless. "Special efforts" are constantly being made in different parts of the country, and in the closing days of the old year Mr. Bickerton's eyes lingered lovingly over a cheque for 2,000 guineas—the result of the famous Nottingham bazaar, and incessant labour on the part of a thousand teachers for the past twelve months. Singularly enough the very same post which brought this "record" cheque from an association also conveyed one for £1,000 from Mr. C. W. Hole (member of the Executive, and a former chairman of the Council), being the first prize awarded by the *Daily Mail* as the result of its "Fiscal Poll." Opinions differ, of course, as to the value of the *Daily Mail* in journalism. Opinions vary also as to the propriety of any journal attempting to anticipate the verdict of a general election; but there can be no two opinions regarding the zeal, and energy, and organising ability displayed by Mr. Hole in his successful effort to secure the £1,000 *bonne bouche* for the B. and O. Fund. Misrepresentation of his motives caused his prompt retirement from the contest for the vice-presidency of the Union. Some of his fellow-members of the Council did worse than "throw cold water" on his schemes. Yet he persevered through all, and the fact that he was enabled to forward 94,039 voting forms shows how assiduously he must have worked. Mr. Hole stated in a letter that he had the assistance of teacher friends throughout the length and breadth of England; and, incidentally, he was able to secure a fine advertisement for the Fund, through the *Daily Mail* stating that this Fund "has paid £21,468 in annuities, and rendered assistance to 754 orphans, besides granting 105 annuities to masters, mistresses, and widows of masters."

Windfall for the "B. and O."

* * *

AS the final words of the preceding paragraph were being penned, there came to hand the assistant secretary's interim report, which states that the grand total of the amounts received by him during 1903 as subscriptions and donations to the Fund is £16,269, 10s. 7d. Of this huge sum, however, (*a*) £112, 6s. 2d. received in January last as "late subscriptions" on account of 1902, (*b*) £103, 13s. 4d. received from the Committee of the Dr. Heller Memorial Fund, and (*c*) £145, 15s. 6d. "reserved" moneys transferred, must properly be deducted, in order to arrive at the ordinary income of the Fund for the year. Allowing for these deductions, it will readily be seen that this ordinary income is actually £339, 15s. 6d. in advance of the splendid sum received for 1902.

A Splendid Total.

1903.....	£15,907	15	7
1902.....	£15,577	0	1
Increase....	£330	15	6

This is a magnificent result, and all who have in any way assisted to achieve it merit the heartiest felicitations. Of the large amount mentioned above, no less a sum than £13,484, 9s. 4d. was received during the month of December. Welcome as the cheques, P.O.O.'s, etc. undoubtedly were, I imagine that Mr. Bickerton and his colleagues would gladly see the writing of receipts and acknowledgments distributed more evenly throughout the year.

THE following is a complete list of nominations for the Council for the ensuing year. (It is possible, of course, that there may be withdrawals before the voting papers are issued to members of the Fund.)

"B. and O." Elections.

District.	Names of Nominees.
1. North England...	Mr. W. J. Weston.
2. Lancashire.....	Messrs. J. Mennie and B. South.
3. Yorkshire.....	Messrs. J. Chilman, T. G. West, J. H. White, F.E.I.S.
4. North Midland...	Misses A. G. Selvage, A. N. Stone.
5. South Midland...	Miss S. Dix.
6. East Anglia.....	Messrs. J. Baldwin and W. E. H. Wilson.
7. South England...	Mr. H. Hone.
8. West England....	Mr. F. F. Wheeler.
9. Wales.....	Mr. P. Thomas.
10. North London....	Messrs. W. R. Hamblett, J. Hodge, A. Tutt, G. S. West.
11. East London.....	Miss E. A. Combes, Messrs. J. Brown, C. W. Hole, T. R. Rand, E. Stollery.
12. South London....	Mesdames E. M. Burgwin and K. Truelove, Misses E. Ansell and E. Carter, Messrs. W. Brenchley, C. J. Chase, R. Greenwood, and A. E. D. Lowden.

It will be observed that there are no contests in North England, South Midland, South England, West England, Wales, and North London. A particularly exciting struggle will arise in Lancashire, when Liverpool and Manchester, through the respective personalities of Mr. J. Mennie and Mr. B. South, again antagonise each other. One gentleman *must* lose, and personally I shall be sorry whichever it is. In Yorkshire, Mr. T. G. West is certain of the reversion of "the chair," and, in this event, my old college companion, Mr. J. Chilman, will probably be allowed to continue his good work of the past year. Anything may happen in North Midland, but Mr. Baldwin has apparently an easy task in East Anglia. Amongst the eight candidates for South London are no fewer than *seven* present members of the Council. My one regret is that they cannot be *all* elected, for every one has a splendid record of good work.

* * *

POSSIBLY the most important of the Standing Committees of the Executive is the Education Committee, which deals with all the purely educational work (other than examinations) of the Union. For nearly two years it has been constantly advising *re* the constitution of Education Committees all over the country. The "eternal salary question," too, has occupied almost countless hours of deliberation and thought, and the new "county combinations" are being closely watched. It may not be generally known that representatives of the education authorities of Cheshire, Staffs., Derbyshire, Leicestershire, Notts, Lincs. (Lindsey), and Yorks (North and East Ridings) have met, in order to form a salary scale applicable to all these counties. It is further understood that a scale for class teachers has actually been so prepared. Again, a kind of "home counties" federation, representing Berks, Bucks, East Sussex, Essex, Hampshire, Herts., Kent, Middlesex, and West Sussex, has held a meeting under the chairmanship of Mr. J. R. Diggle, a former chairman of the London School Board. The idea here again is, of course, to prevent authorities outbidding one another for the services of teachers, although there is an ingenuous sort of understanding that any authority adopt-

The Salary Question.

ing the combination's scale *is not to be precluded from offering a lower commencing or final salary than this scale.* To the unfortunate teachers, it seems to be a case of "heads, we win; tails, you lose." But I venture to prophesy the combinations will be powerless. Apart from the attractions of the big county boroughs, which will always demand and pay for the services of *the best* teachers, there is the obvious scarcity, nowhere more clearly evidenced than in the thirty or forty columns of "teachers wanted" printed weekly in the *Schoolmaster*. For once the sweaters' plea of "supply and demand" appears to be on the side of the teachers; and 'tis as well so, just by way of a change.

A. C.

NOTES FROM THE NORTH.

EVEN in summer it is considered a far cry to Inverness, but in mid-winter few of us would willingly undertake the journey were we not animated with the desire of showing our northern friends how much we appreciate their great efforts to make the first Highland Congress of the Institute—what it really turned out to be—a phenomenal success. The members of the Institute had hopes of attending a Congress in Inverness in 1900, but the tragic and sudden death of Major M'Kenzie, that typical Highland teacher, on the eve of his installation in the presidential chair, shattered these hopes. But now that the President of the Institute hails from the north-west province, the thirtieth annual Congress has selected Inverness for its meeting-place. As was only to be expected, the Highland problem, as it has not inaptly been designated, occupied the first place on the programme. Undoubtedly in no part of Great Britain do more difficulties and drawbacks, both to teachers and taught, exist than in the Highlands and Islands of Scotland. As the president in his address put it, "their geographical position, the internal barriers of land and water, and the want of means of communication, have all hindered, and to some extent still hinder, the development of education in the Highlands in a much greater degree than many outside the area have ever dreamed of."

The E.I.S. Congress.

INVERNESS.

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THE president, Mr. T. Wallace, F.G.S. (Edin.), F.S.A. (Scot.), High School, Inverness, after rapidly sketching the history of education in the Highlands for the last five hundred years, pointed out that we were already feeling the pulsations of a new educational movement for Scotland, but no Bill should be accepted that did not include every grade of school from the elementary to the university—so graded, and the sphere of each so defined, that those in charge of the different schools or departments would feel that they were important units in a truly national system. Teachers and educationists should be fully alive to the importance of the opportunity soon to be afforded to them to secure the best possible measure. Teachers were well aware of the defects of previous measures, and out of their past experience should be able to advise what to keep and what to discard. It was therefore to be hoped that in the coming discussions, which were sure to be keen over the local authorities and administrative areas, the essentials of education be not lost sight of, and the Highland problem kept well to the front. Owing to the sparseness of the population in the Highlands and the limited number of educational centres, the grouping of schools there is notoriously a much more difficult matter than it is in the Lowlands.

Looking Forward.

* * *

MR. WALLACE suggested, with regard to this very difficult subject, that in certain parts of the Highlands and Islands the best plan would be to consider a certain number of small schools as departments or classes of one central school, where boys and girls who showed ability to profit by higher education could be prepared for the examinations prescribed for county and parish bursaries, or entrance to secondary or technical schools. To induce teachers of the necessary scholarship and organising powers to settle in such districts, a handsome

Grouping of Schools.

salary would require to be offered. If some such arrangement were possible, the lives of teachers in the remote and inaccessible districts would be brightened, and a stimulus given to education in such areas that would more than justify any extra expenditure, which might not necessarily come out of the rates. From such central schools, if necessary, pupils might be drafted to the higher secondary or technical schools; and as some of them could only take advantage of such education if aided by bursaries, it was necessary that the bursary system be very carefully considered. Probably this is the only way in which the gradation of schools in the Highlands can be successfully carried out. Even this will involve an outlay for bursaries on the one hand, and on the other the erection in the Highland town centres of definite secondary schools. We may feel sure that whenever the question of the reorganisation of Scottish education comes to be squarely looked in the face, the necessity for largely subsidising, if not absolutely creating, the fabric of secondary and technical education will be clearly seen and accepted.

SIR ROBERT FINLAY, K.C., M.P., Attorney-General for England, in proposing a vote of thanks to the president for his address, said there were two points in which the education question in Scotland differed very widely from that in England. The first was that in Scotland they had a genuine enthusiasm among the people for education. Whatever might have been the case in the past, he believed that in that enthusiasm the Highlands shared quite as much as the Lowlands. In England the educational reformer very often had to endeavour to create a desire and willingness among the people to accept the benefits which the State was anxious to afford. In Scotland they found among the people a most intense desire, not merely for the acquisition of knowledge, but for the training of the mind; and all that the statesman had to do was to see that the best means were provided for giving effect to the aspirations of the people. Another point in which the education question in Scotland differed from that in England was that in Scotland the religious difficulty did not exist. No doubt that was to a very large extent due to the fact that among the parents of those who attend the public schools in Scotland there was, practically speaking, an identity of doctrine. There was no division of doctrine among their great Presbyterian denominations. But even where there was no such identity of religious belief, as was the case in certain districts in Inverness-shire—notably in the island of Barra in the Outer Hebrides, where the great majority of the people were Roman Catholic—the common sense of the people had triumphed over any such difficulty.

The Education Question in Scotland.

MR. C. H. OWEN, M.A., Easdale, Argyllshire, who has given considerable attention to the rural problem, gave a most interesting paper on this subject. In any scheme of rural school reform, he said, the four essentials were, firstly, consolidation of our rural School Board districts under an authority competent to administer rural education, and to correlate the rural primary school with the higher centres; secondly, that rural school finance be put on a sound basis; thirdly, that the rural school be so levelled up, that no rural pupil suffer any serious disablement in his educational career; and fourthly, that the rural teacher's work, position, and prospects be such as will render him contented with his lot, and attract good teachers to fill our rural posts. He considered that in the principle of combination we had a sound working basis for all such reform. As applied to the external conditions, combination meant consolidation of school districts as the requisite basis for good management and for the co-ordination of all grades of education; and such consolidation presupposed, and would ultimately bring about, equitable financial conditions for all the schools administered. As applied to the internal conditions, combination could, through the grouping of our rural schools, and through the co-operation of the staffs, create those conditions which would make for the efficiency of the rural school and the betterment of the lot of the rural teacher. In the former case we had the administrative problem, in the latter we had in the main the educational. Fully half of the schools of Scotland were of the strictly rural type, for, if the line were drawn even at a register of 100 pupils, the figures were 1,525 as against 1,599 of over 100 pupils, the former total being made up of 786 with fewer than 50 pupils, and 739 between 50 and 100. The great majority of these 1,525 schools were inadequately staffed, and 933 of them had only one teacher, so that a high standard of efficiency was unattainable.

Rural School Reform.

MR. J. HARRIS, member of the Executive of the N.U.T., conveyed the greetings of the 50,000 members of that body to the Congress. He remarked that as regards Scottish education they were looking forward to a new Education Bill for Scotland, and it might be on the lines of the English Act—an opinion which found no countenance with a large body of the members of the Institute present. However, he might be allowed to say that the English Act of 1902 was really the beginning of a great national system of education, making, as it did, each school fit into the niche it ought to occupy in the educational system. He would like to see the religious test abolished, but he believed the English teachers and the English people would ere long find a way for the solution of this difficulty. He referred to the good work that was being done by several educational authorities with regard to the training of teachers. Mr. G. Hyden, the other delegate from the N.U.T., was given an opportunity of conveying fraternal greetings both at the class teachers' smoker and the dinner. He congratulated Scotland on the respect paid in that country to education and the educator. In England they had in this matter considerable leeway to make up, but he expressed the hope that progress in this direction would be steady and rapid. Mr. J. Hazlett, Dublin, as the representative of the I.N.T.O., said that there was a growing feeling in Ireland in favour of a closer union among Irish, Scottish, and English teachers, both in the interest of education and of the educators. Were such an international union formed, he felt that their demands would be irresistible.

Foreign Delegates.

TO Mr. W. J. Gibson, M.A., Nicolson Institute, Stornoway, was entrusted the paper on the Training of Teachers. The present dearth of teachers

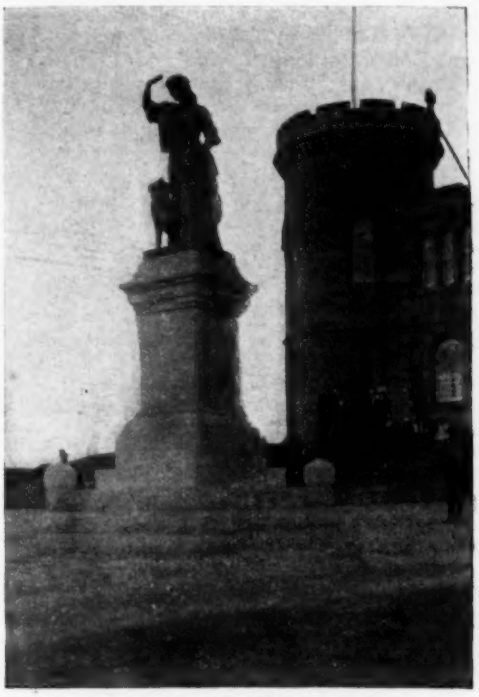
Increased Facilities for Training of Teachers.

was being felt more acutely in the rural districts than in the urban centres, and most acutely of all in the Highlands and Islands. Taking the island of Lewis as his concrete case, he pointed out that for the 4,750 children on the roll in the 36 rural schools there were provided 77 adult teachers. Of the 47 assistants, there were 6 trained, 2 untrained but certificated, and 39 untrained and uncertificated. In a word, the education of the majority of Lewis children was in the hands of Article Seventy-niners and pupil teachers. In the Hebrides, trained assistant teachers are practically not obtainable at all. There was only one certificated teacher for every 102 in average attendance in a difficult district like Lewis, where, if anywhere, the most skilful workers that the training colleges can turn out would find an educational problem difficult enough to call forth all their energies. Nor was Lewis an isolated case. The same conditions were found, doubtless in a less degree, in all the remoter districts of the country, and were yearly becoming more pronounced. The education of the rural children of Scotland was passing more and more into the hands of untrained assistants. He suggested several remedies for the present state of matters. Of these one or two may be noted. Uncertificated teachers in service in rural districts should be grouped in holiday courses at the nearest central school for further instruction in methods of teaching. Something should be done to increase the rural pupil teacher's chance of meeting on fair terms the admission examination. The present training accommodation should be extended by the institution of new training colleges. One of these should be placed in Inverness.

* * *

The New Equivalent Grant.

THE allocation of the new equivalent grant formed the subject of a most practical paper given by the Rev. Dr. Mackay, Wick. The minute of 28th May last had, he said, failed to effect the improvement desiderated. In particular, it was defective in that it did not touch the case of the smallest and most necessitous schools—those schools in which a single teacher or a teacher and pupil teacher were in charge. His contention was that it was better to make certain that there was in each school one thoroughly efficient



STATUE OF FLORA MACDONALD.

teacher, than that the number of ex-pupil teachers should be increased. That this might be accomplished, the Department should assist School Boards to pay, and should insist on it that any teacher should be paid, an adequate salary. For the sake of my readers I may explain that the new Equivalent Grant gives a School Board a contribution of £40 to each school having an average attendance of 60 or under, on the staff of which, in addition to the principal certificated teacher, at least one ex-pupil teacher is employed; to schools with an average attendance of 100 or under, where at least two other teachers are employed under similar conditions, a sum of £30; and to schools with 150 or under, for three teachers, a sum of £20. The result of this hurtful minute has been the employment of ex-pupil teachers, who, so great is the demand, cannot now be got for less than £60. The Department, as I have had occasion to say in these notes, has made a grievous mistake; and since the minute was only tentative and for one year, it is earnestly hoped that it will be withdrawn.

THE CALEDONIAN CANAL.

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THE local colouring of the Congress was strongly in evidence in the resolution moved by Mr. W. J. Watson, B.A., Inverness. He proposed that the recognition of Gaelic as a subject counting for the Leaving Certificate was highly desirable. Among the reasons that he adduced for this were :—(1)

Gaelic and the Leaving Certificate.

The recognition of Gaelic would at once place the study of Gaelic on a higher level in schools where it is already taught, and probably tend to secure its being taught more widely than it is at present; (2) it is only fair to teachers who are willing to teach Gaelic, and to pupils who desire to learn to write it grammatically, that they should have their work so tested; (3) Celtic is recognised as a subject for the Degree in Arts at the University of Edinburgh, and a preliminary examination is required in Gaelic equivalent to the standard of that in Latin and Greek; (4) Gaelic is an essential qualification for ministers all over the Highlands and Islands, and it is desirable that they should be able to speak and write the language with correctness; (5) Gaelic is already recognised as an extra subject for the entrance examination to the training colleges. As was only to be expected, the resolution was passed with acclamation, though without discussion. In fact, the lack of discussion with regard to the several resolutions submitted was felt to be one of the weaknesses of an otherwise very informative and practical Congress.

MR. MUNRO FERGUSON, M.P., dealt with this important question. The educational mind, he said, had been stirred over singularly outspoken and pointed expressions of opinions at their conferences and in Parliament, and last winter there appeared a comprehensive plan for Scottish educational reform. These resolutions and that plan had held the field for nearly a year without opposition. Glancing for a moment at the wide question, he held that happily with us educational reform was very little of a sectarian question, and in no way political. There were points on which all parties were agreed—for one, that legislation was long overdue. Again, no one would deny that co-ordination was their first need. This involved the consolidation of many authorities, the strengthening of them all, the uniting and knitting together of all classes of education under one authority. Further, there was a united demand for the extension of the higher and technical departments, for their better equipment, and for their more even distribution. That necessitated more money. He paid a tribute of recognition to those new economists, professorial or political, who had given so sudden, fresh, and powerful an impetus to public interest in our commercial position, because that would all help to a larger educational programme. As regarded our system and administration, the two cardinal points were that School Boards should control the whole education, elementary, technical, and secondary, within their area, and that a Scottish Council of Education was the keystone of the educational arch. To establish the latter meant the transfer of potential power to Scotland, for no Scottish council could be either representative or effective in London. The two, taken together, formed a complete and flexible system.

Coming Educational Legislation.

The Advisory Council.

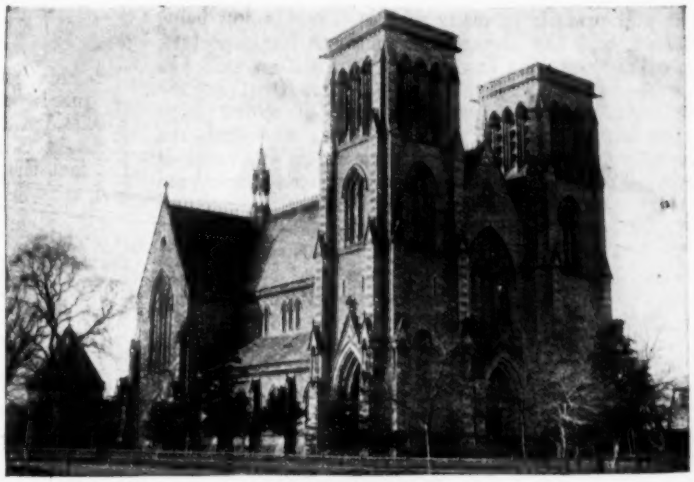
AS educationists they must insist upon the reconstruction of the central authority, even if that reform was not one which was pressed for at Dover House. Mr. Munro Ferguson could not believe that, if the Department had been amongst us, and in combination with a council representative of Scotland's educational talent, we would still be waiting for co-ordination of our schools; that it would have been left to unofficial effort to draft a plan of reform; that the national objective should remain so blurred behind the ordinances, minutes, circulars, and memoranda scattered by the Department; that so many unnecessary and overlapping educational authorities would have remained to be stricken with paralysis; that there would have been no effort not only to secure efficiency but money. It was not the *personnel* of the Department but the system he had to find fault with. There was no sufficient manual through which information and ideas could flow in from the locality to the centre, no effective machinery to sift it when it got there. The inspectorate was too much the agency of a limited bureaucracy. Yet if there was any section that should be able to introduce method and system in its affairs, it should be educationists. Going on to adduce reasons for this proposed change, he mentioned the issue of the minute referred to above, which had been so generally condemned, and the ordinance which restricted some forms of education and specialised others in the elementary schools, neither of which could have emanated from a Scottish National Council of Education. There were other points with which this body could grapple. The training college system was as absurd in theory as in practice. The construction of side schools, too, proceeded while the transport of children to central schools remained.

Educational Administration and Superannuation.

THE Institute's policy on the above subject is very much in accord with the opinions expressed by Mr. Munro Ferguson, and was embodied in the following resolution submitted by Mr. Lawrence, General Secretary: "That any proposed reform of the educational system of Scotland should provide for (1) enlarged administrative areas; (2) local authorities directly elected to manage all classes of schools; and (3) an advisory council to the Scotch Education Department. The resolution on Superannuation was purposely vague and indefinite, but the speech Mr. S. M. Murray, Organising Secretary, made in support of it rendered the position of the Institute clear and explicit. As a matter of fact, the Parliamentary Committee of the Institute had at its recent meeting prepared certain recommendations on the subject, and these Mr. Murray submitted. These are (1) that the teacher's contribution to the annuity fund should be proportional to salary, say 2 per cent.; (2) that the local authority and the Government should each contribute to the fund a sum equal to the teacher's contribution; (3) that female teachers have the option of retiral at the age of fifty-five, and male teachers at the age of sixty; and (4) that the Government increase its contribution to the Superannuation Fund, so that teachers in the service at the passing of the Superannuation Act of 1898 might receive an adequate pension. He suggested also that the contribution to the Superannuation Fund should be made a first charge upon the Equivalent Grant. A resolution proposed by Mr. Pollock, Beauly, was also unanimously passed to the effect that the General Committee of Management of the Institute be asked to take steps for the formation of an insurance and benevolent society for teachers, for the purpose of providing annuities for their widows, and school and university bursaries for their children.

DR. BRUCE, Dingwall, who dealt with the medical inspection of schools, agreed that already too much was expected of teachers, and he would be sorry to add to their weighty responsibilities. He held very decided views, he said, as to the absolute need for limiting the medical inspection of schools within due limits; but surely the school ought to be made the centre for the propagation in a practical, every-day shape of the great principles of hygiene. Most school buildings in rural districts had been set down in situations and planned internally with the utmost disregard of the laws of health. A certain number of cubic feet were insisted on by the Department, but the air space was absurdly small. School premises should be elastic, so as to provide for changes in keeping with the number of pupils and with the varying conditions of education. The teachers must co-operate with any agency established for the purpose of mending or ending the present hygienic system; but Dr. Bruce was at one with the resolution of the medical officers of health, that the hygienic control of the schools should be in the hands of the medical officer of health of the district. The evidence obtained by the Physical Commission had established the great necessity for examinations of the pupils in the interest of the scholars individually, and it would be more decidedly needed if physical training became a compulsory portion of school work. He concluded by moving that the Congress believes the time has come to consider the propriety of establishing a periodical medical examination into the physical condition of each individual pupil, with a record of the results of the same.

Medical Inspection of Schools.



INVERNESS CATHEDRAL.

IN THE ISLANDS.

CIRCULAR 374 is responsible for the appearance of this subject on the Congress programme. Mr. Cheyne, M.A., Alves, in a spirited and convincing paper, animadverted on the entire removal of the higher subjects from the curriculum of the parish school. He characterised it as an act of educational vandalism, and trusted that the educated opinion of Scotland would never sanction such a procedure. The subject was spoken to by Mr. Stephen, Lhanbryde, who, in a most eloquent and heartfelt speech, maintained that it would be a real calamity for Scotland if the higher subjects were discouraged in rural schools. He would be ashamed, he said, to think that his name should go down to posterity as one of the teachers in whose day the privilege of secondary subjects was lost to the parishes. If any part of Scotland has felt the unjustness of Circular 374, it is the north-east province of Scotland, where, owing to the admirable work done by the Dick Bequest, secondary education has been their glory and tradition for the last half century. In no part of the British Isles has such sound educational zeal been maintained. Nowhere have the teachers been so helped to do all they could to advance the interests of education. Many in the audience were carried away by the earnest appeal of Mr. Stephen, and few there were who felt that the scathing criticism was not deserved. It has taken the teachers of Scotland some time to make up their minds on the reactionary tendency of Circular 374, but it is to be hoped that now they have seen it, they will keep the matter prominently before the public, both in the interests of education and the pupil.

Supplementary Courses.

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CIRCULAR 223, by its freedom from individual examination and its introduction of periodical advancement, left much in the hands of teachers. Mr. Small, Glasgow, President S.C.Y.A., in a well-reasoned and cogent paper, showed that teachers had not yet realised their responsibilities and taken advantage of the freedom granted by that circular. There was a tendency to leave things simply as they were. No doubt the large school was greatly to blame for such a condi-

Classification in Large Schools.

tion of affairs. The Government's habit of issuing circulars and not seeing that they are carried out has also contributed to the unsatisfactory classification that still prevails in many schools. This is now being realised, and the Department, through its inspectors, are calling attention to the want of classification. Age classification, largely the result of the Department's obnoxious method of paying so much grant for pupils under seven, between seven and ten, and over ten respectively, has in many quarters taken the place of attainment classification—the only true and educational classification. On the motion of Mr. G. Fenton, Aberdeen, Congress unanimously passed the following motion: "That in order to secure the best educational results in our public schools, this Congress is of opinion that classification should be according to attainments, and should in no way be dependent on the age of the pupil."

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An Educational Bureau.

TO Miss Fish, L.L.A., Glasgow, was entrusted the last subject on the Congress programme. Miss Fish is extremely well qualified, from the interest she has taken in this subject, to convince Congress of the necessity for undertaking such work on behalf of the Institute. She would like to see a bureau for the teachers in each of the six provinces, though it might be advisable to begin by opening one in each of the two centres of Edinburgh and Glasgow. It is proposed to raise the necessary funds by holding a bazaar. Miss Fish pointed out that for bazaars for churches and other organisations the lady teachers of the Institute were constantly working, and she thought they should for once be selfish, and work for themselves.

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After Thoughts.

AS I hinted in last month's notes on the Congress, the programme was decidedly overloaded. No matter how rigorously the papers introducing the various subjects were restricted in time, nevertheless the time for discussion was not found. In one or two cases the speakers, who had evidently prepared papers which were too long, simply read them at breakneck pace. It was neither good for the paper nor the audience. The local officials, who must have worked like Trojans, are to be congratulated on placing the Highland problem so prominently before the country. The business-like earnestness and professional zeal with which the various subjects were tackled will go far to make the first Highland Congress stand out in the history of the Institute. Perhaps no Congress has been more representative in its attendance. There were teachers from all parts of Scotland—from the lonely western islands, "from the outer rim of the Celtic fringe," as one speaker very aptly phrased it, as well as from the more favoured, shall I say, and densely populous southern counties. All the functions—social and educational—were largely patronised and highly successful. To Mr. G. Cameron, the genial secretary, Messrs. Stafford, Hill, Maconnochie, and Pollock, are due the warmest thanks of those who sojourned for a short time in the Highland capital. Mention should also be made of the artistic and interesting handbook, written by the president, and generously presented by Messrs. T. Nelson and Sons, from whose pages we are permitted to borrow the illustrations which accompany these notes.

R. G.

CHILD STUDY AND THE TRAINING OF THE TEACHER.

BY J. GUNN, M.A., D.SC.

IN this paper I wish to consider Child Study as a necessary part of the teacher's equipment for his work. Perhaps I ought rather to say, for *her* work. I should make this amendment not merely in view of the fact that the work of teaching is becoming more and more a work for women, but more especially because it is to the women rather than to the men that we must look for such an improvement in equipment as is indicated in my opening sentence.

Women are said to be more conservative than men. That is strictly true, and I impute it to them for righteousness. But they are more ready to attend to new ideas which may be of use to them in their teaching, and more willing to make experiments. The reason is that they usually take their work as teachers more seriously than men do, and they realise more fully its responsibilities and its possibilities. A woman is apt to regard a child as having more importance than a man is ready to concede to it, whether in school or out of it. When I say that Child Study is a necessary part of a teacher's preparation, I shall be more readily believed by women than by men. But the truth applies to men no less than to women, and to teachers of advanced classes as well as to teachers of infants.

The necessity for Child Study as part of the teacher's training is evident when we consider what Child Study really is. In some quarters it seems to be regarded as a more or less unholy cult, like spiritualism or table-rapping; a form of that mischief which is said to be always found for idle hands to do. Those who engage in it are regarded as fanatics, to use the term chosen by Professor Laurie, or as faddists, a term applied to people whose opinions differ from our own regarding the importance of any truth.

Child Study is merely the careful and systematic observation of children in order to discover the phenomena and laws of their development. It is our only means of knowing by what stages a child becomes a man or a woman. And this is precisely what a teacher needs to know. The teacher undertakes to superintend the growth, if it should be only the mental growth, of his pupils. This is too narrow a view of education; but even on this restricted view it is plain that the teacher must know the laws of mental development if he is to attain anything better than mere rule of thumb in his methods, if he is to reach any degree of certainty regarding the foundations of his daily practice, and if he is to avoid the risk of doing harm to his pupil instead of good. Even on this limited view it is surely clear that Child Study is the only scientific basis for educational practice.

We have now a section of the British Association devoted to what is called Educational Science. There has been, so far, no attempt made by that august body to lay down any scientific principles by which to test the truth or error of any statement regarding education. There have been the usual discussions on curriculum and methods, and the usual appeal to results or to authority for justification. Such discussions will never advance the science of education, but they may well perpetuate the doubt whether there is a science of education.

In the first place, the question of education has to do not with subjects, but with the *person* who is to be educated. The first question for medicine is the human body and its laws, not the effect or assumed effect of this or that or the other food or drug. To consider any method of education from the standpoint of its alleged results is unworthy of the present century, surely, in a civilised country.

The people who resort to the beating of drums and the blowing of trumpets when an eclipse of the sun takes place, in order to prevent the sun being eaten up, may be excused for pointing to results as *their* justification, and they can prove by an unbroken series of successes that the noise of their performance has always been followed by the reappearance of the sun. But it is clear to us that to discuss the subject of eclipses requires some knowledge of astronomy, and not of music alone. We require to know something of the sun and the moon before we can say that our music has any effect upon them, apart altogether from anything that may follow our efforts.

In education it will not do to point to certain results in the pupil which follow some particular treatment in school, and to assume that those results are due to that treatment. There may simply be no causal connection between them. The utterly empirical nature of such theorising is evident when we remember that on almost every conceivable point of educational theory people have been found to hold diametrically opposite views, and to justify them in every case by pointing to results. It is not in this way that a *science* of education will ever emerge.

The science of education, like every other science, must begin with a thorough *investigation of its data*. And in education the all-important datum is the *child*. Up to the present time educationists have attended chiefly to the secondary data of education, as we may call them, to the result to be aimed at (the educated man), or to the knowledge which the educated man must possess (the curriculum), or at best to the laws of thought and of conduct applicable to the adult.

There can be no doubt that in attending to the study of psychology and logic and ethics we are on somewhat the right track. We are recognising that the pupil is of some importance in education, as well as the subjects which he is to be taught. But these studies are not quite what the teacher needs. The mental science of our text-books is the science of the adult mind, not of the juvenile mind. And between the juvenile mind and that of the adult there are differences which are not yet fully understood, or which, at any rate, have not yet found their way into text-books. And when those text-books try to help the teacher in his work by dogmatising on the order in which the mental faculties develop in children, they are apt to prove very broken reeds indeed, and to confuse the issue by giving pictures of mental processes which a very little experiment and observation will show to be entirely at variance with what actually takes place in the pupils' minds every day.

The psychology of the child mind differs widely from that of the adult. The child is more under the sway of feeling, and his feelings differ in kind as well as in degree from those of his teacher. He thinks and concludes in defiance of all the laws of adult logic, and yet he often reaches truth by his own road. The essential thing for the teacher is not to try to force the child along the road of logic, but to understand the road which the child prefers to take. *That* is the only road by which true education can become his.

The child's conduct, again, does not come under the rules of ethics as these are found in our text-books. There are motives to action in the child which do not exist in the man; not because the man is morally better, but simply because he has outgrown those impulses, be they good or bad. The man's springs to action, on the other hand, do not appeal to the child as yet, simply because he is a child, and not on account of original sin. The world makes a different appeal to the child, and he naturally responds to it in a different manner. Of course he must not remain a child in conduct any more than in stature; but the change in the one case as well as in the other will be due to natural growth in the first instance, and not to education. We have to superintend and guide this natural growth, but not to create it, and we can only guide it aright if we understand what nature is about all the time. If our want of guidance, or our mistaken attempts at guidance, or any other cause, results in the moral nature being undeveloped while the child becomes otherwise a man, we have that too common phenomenon a moral imbecile or a criminal, who has never realised his proper relations to the society in which he lives. Hence the importance of the teacher knowing not merely his ethics, as applicable to the adult, but the normal stages by which character and conduct develop in the child at various periods of his growth.

Our want of a scientific basis for education is seen very clearly in the way in which we persist in treating the child as if he were built in water-tight compartments, so to speak. We speak of intellectual education, of moral education, of religious education, of æsthetic education, and of physical education—forgetting, apparently, that there can be but one education for one child, and that this education must be the complex resultant of all the influences to which he is subjected at home and in school. We have largely ignored the interrelation of all those aspects of the pupil. We have not considered how much the moral depends on the intellectual, and *vice versâ*, and still less have we realised how much both of these are affected by the physical.

It is a curious but painful fact that, after thirty years of compulsory examinations of all kinds, we are only just waking up to the fact that we have forgotten to examine in the one sphere where examination can do good alone and not harm, and in which nature will see to it that payment will be surely and strictly according to results—that, is, in the matter of physical development. Our educational authorities have at last discovered that our pupils have bodies, and are not pure intellect—hence the tardy inquiry into the physique of school children. But in the meantime we teachers find ourselves in this position, I suppose, that if we do examine a pupil, we cannot tell exactly whether he is normal or not in his physical development. We do not know what a healthy boy or girl ought to weigh or to measure at any given year, more especially in view of the allowances to be made for heredity and other special factors. Our training has not led us to consider such matters as of any importance; or, if important, they do not seem to concern us as teachers. If we are told the age of a pupil, we know at once what he ought to be able to do in reading, writing, and arithmetic; but few of us could tell what ought to be the height of his seat or his desk, or of his hat-peg in the cloak-room. And this ignorance is not confined to teachers.

I suspect that the architects who design our schoolrooms and furniture have quite as vague ideas about the size of those who are to occupy them. Yet the comfort and even the health of children depends much on their surroundings being properly adapted to their stature.

Again, when we lay down our curriculum for any individual, we are in the habit of assuming that he is a normal specimen, and that the traditional course will be the best for him. In the case of a total break-down we see that we are mistaken, and that we have left out of account the chief factor—the powers of the child. But mental application depends so entirely upon physical power that a very little consideration should show us the wisdom of our beginning the plan of our curriculum by taking into account the physical condition of the child. In city schools of the poorer class it may be feared that few of the pupils are really normal in physical development; and if our traditional curriculum is designed for normal pupils, it is therefore unsuited for such schools.

In these sentences we have spoken of physical condition as affecting intellectual education. There is another problem before us, however—the problem of *physical training*—which we have hardly yet realised as coming within the scope of the common school. The near future will see this aspect of education taking a much more prominent place, and teachers will have to reckon with it.

Here we have no traditional course to aid us or to hamper us. We shall have to devise our own methods. How we are to do this without a much closer study of the child than we have yet bestowed on him is more than I shall venture to predict. I should rather hope that we shall not attempt to solve the problem without a really careful study of its conditions.

One of the many hopeful things about this new interest in physical education is just this—that it will necessarily throw the teacher back upon the facts of the child's nature in a way that nothing has yet done. We shall learn that here, at least, education is a matter of growth rather than of training, and that education at its best is simply the guidance of growth. And to learn this lesson is to discover the further truth that the guidance of *any* form of growth implies a knowledge of the laws and phenomena of that growth. This is really the whole case for insisting that Child Study is a necessary part of the training of the teacher.

You may be ready to grant that a thorough knowledge of the facts of development in children is an essential part of the teacher's equipment, but you may wish to add that all this may be *learned from books*, without the need of any practical work or original study by the young teacher. That is not a wise position to take up. In these modern days we are not content even to learn our geography from text-books, although one might well argue that our best way of learning about the world is to read the accounts of those who have seen most of it. We have come to realise, however, that only *after* the actual seeing of geographical phenomena, and the actual constructing of maps, are we able to realise what books and maps have to tell us. So learning must come through doing, even in a science so little connected with practical work as geography. In the more practical sciences we see still more clearly the value of actual doing as a means of learning. It is for this that we build school and college laboratories, and not for purposes of research. Our purpose is to give clear ideas to our pupils, not to advance the science in which they are occupied. So to engage in Child Study by means of books and lectures alone would be to resort to imperfect and obsolete methods of giving real knowledge to the young teacher.

Practical work, corresponding to a laboratory training, is of the essence of the course of Child Study which I have before my mind when I say that such study is a necessary part of the teacher's equipment. The main purpose of such practical work is not to make new discoveries regarding children; but so little do we yet know accurately regarding them in many aspects, that any course of practical work would be almost certain to result in some new facts being brought to light. Little more than pioneer work has as yet been done in many departments, and there is plenty of room for the ambitious and enterprising student to win distinction in this unoccupied field of research.

There is one yet stronger reason for including practical Child Study in the teacher's course of training, and that is this: A great and important part of the teacher's daily work will consist in the study of his pupils *individually*. All the knowledge which can ever be crammed from text-books regarding children will not change this problem. He has not merely to know *about* children; he has to know this and that *particular child*, and to adapt his treatment of each child to what he discovers to be his individual character and his special powers or weaknesses. So a practical training in Child Study is necessary in order that he may learn how to study and to observe children for himself.

You may suppose yourself to be teaching a class, but it is the individual children that you are educating or failing to educate. The best teacher always knows most about his pupils individually. To many the power of thus knowing children comes naturally; they study them, as it were, unconsciously. An early training in the conscious and systematic study of children would render such natural powers all the more effective, while it would help to develop similar powers to a certain extent in all teachers. The "born" teacher would at the worst suffer no harm, and would probably derive some benefit from it, while the ordinary or "made" teacher would certainly derive an enormous increase of power from the exercise.

I do not know of any training college in this country where Child Study has as yet a distinct and important place on the curriculum, though there may be such. In America, the land of experiment and invention, Child Study is represented on the time-tables of many of the best Normal institutions, and the psychology of childhood, as distinct from the ordinary psychology, is taught from special chairs in several universities. University recognition of *Psychologie Enfantine*, or Genetic Psychology, is also becoming somewhat common on the continent of Europe.

The city of Chicago boasts of being a pioneer, in so far as its Board of Education has been the first to institute a Department of Child Study under a specially qualified director; and the annual reports issued by this Department bid fair to occupy a high place in the literature of the subject, from the eminently practical character of their inquiries. The Board have realised that in many things their work is being carried on in ignorance of facts regarding children which it is of the utmost importance for them and for their teachers to know, and like sensible men they have set about trying to discover the facts. Unless our Boards of Education already know

all about children that it is necessary to know, it would be wise in them also to see that such inquiries are made in this country.

The first group of facts which Chicago set itself to examine was the normal conditions of boys and girls at each year of their school life as to their physical measurements and muscular strength, and along with this to determine to what extent any deficiency in physique was accompanied by deficiency in intellectual power as indicated by their standing in their school work. This is in the first instance a mere inquiry into facts. These facts will remain to guide any course of action which it may be felt advisable to undertake by-and-by in order to improve either the physical or the mental treatment of the children.

The last inquiry of which I have heard as being undertaken by the Chicago Board has been made with the view of finding out the best form and size of school desks and seats to provide for pupils at various ages. If they succeed in determining this, they will have made a new discovery in education. For this is a point which, however simple, has not yet been seriously investigated. We are content to leave the matter to our architects, or to those who furnish our schools for us. There are serious dangers to health involved in sitting at desks and on seats which do not permit of the pupil assuming and maintaining a proper attitude; and we have known this for years perfectly well, but we have not yet taken the most obvious way of avoiding such dangers—namely, finding by actual and careful measurement what are the proportions which suit the actual stature of children at different ages, or at the various stages of their school career. The thing is so simple that we have overlooked it in our educational theorising.

In our own country several of our more enlightened School Boards have made some tentative movements in the same direction, by calling in the aid of qualified medical men to conduct special investigations. Most of those inquiries have been with regard to the sight and hearing of school children—points on which the teacher naturally needs at first the guidance of a skilled specialist in the application of tests.

But those inquiries among us are in the meantime only sporadic and haphazard. They have not taken the form of regular and systematic departments of educational work. We shall come to that soon—sooner, perhaps, than some of us would have thought possible a few years ago. Like good Britons, we have stumbled upon the importance of this form of Child Study by chance or by accident, and not by any process of rational thought or logic. It began as really a military question. We fell into a kind of panic lest our recruits for the army should by-and-by degenerate so much that they should no longer be able to carry a rifle, to say nothing of using it. We should have had more pleasure in the movement had our educational leaders begun their investigations out of a regard for the children themselves; but from whatever cause the inquiry has arisen, the more careful study of the physical condition of the young can only be productive of good.

With this inquiry teachers may have little to do at first—probably too little. But it is an inquiry which will come to stay. It will not end with the discovery of facts about the children now in our schools. The measurements and other details regarding pupils which it will be found necessary to record *now* will also be made *in future* regarding all pupils. It is a new form of examination and registration, and it will be found of the utmost value when once we have learned how much physical facts can reveal to us. For a physical fact never stands alone and unconnected. It has causal relations with all the other facts about a child. The mental, the moral, and the physical are bound up with one another in the most intimate way; and of all these the physical is by far the most easy for us to measure, and hence forms the most ready index to the pupil's development and promise for the future.

If such investigations and records are to be part of the teacher's regular work in future—as we think and hope they will, in the interests both of the teacher and of the pupil—it is surely very desirable that our young teachers should be instructed in the methods and in the importance and significance of the work. As a laboratory exercise it should possess as much interest as any of the natural sciences which have recently been added to the training college curriculum, and it has a more direct bearing on school work than any other science that could be mentioned.

But the physical is only one form of that Child Study which is now included in the course of many colleges in America, as has been already mentioned. The American colleges are practically free to devise their own course of study. Each of the states is its own supreme authority in education, and the State Board of Education usually take the sensible plan of choosing the best man they can find for the head of a college, and then leaving him practically free to follow his own methods of professional training for his students. There is no government code or syllabus. This gives room for the working out of the best ideas which an educationist may possess, and offers a field for many improvements which it would be impossible for us to attempt under our system.

But this system, or want of system, has one disadvantage when one comes to study the American colleges: he can come to no *general* conclusions regarding them as a class; he must deal with them as individuals. So, when any statement is made about American training colleges, it cannot refer to them all, but only to certain unspecified ones which the speaker has in his mind. There is probably no general type; each has developed, and is still developing, along its own lines.

If we take the State of Massachusetts as an example—probably a favourable example on the whole, since Boston claims to be the most cultured city in America (that is, in the world)—we find that in several of its ten State normal schools Child Study has an important place in the course of training. It is included either in psychology or in what they are in the habit of calling by the repulsive name of pedagogy—that is, the theory of education.

We may note in passing one arrangement which is very general in American colleges, and which leaves the professor of education more free to widen his course than is possible among us at present. The *method of teaching* the various special subjects is usually entrusted to the professors of these subjects in the college. For example, the professor of arithmetic or mathematics not only teaches this subject to the students, but also shows them the best methods of teaching it in school to their pupils. The time of the professor of education is thus less taken up with questions of school method, and he is free to deal with wider questions.

(To be concluded in our next issue.)

DR. JAMES KNIGHT,

HEADMASTER, ST. JAMES'S PUBLIC SCHOOL, GLASGOW.

"THE headmaster's organisation and management of this school continue to merit the very highest praise. I have not yet seen any school in which the educational aims of the new Code seem to be so clearly apprehended, or in which method in organisation and teaching is so skilfully applied towards the securing of these aims to the fullest extent possible in the ordinary elementary school."

Such a report by one of the most scholarly and most highly experienced of H.M. Chief Inspectors naturally draws the interest and attention of all teachers who are striving to be real educators. And when to this tribute to professional skill we add the recent academic honour—the blue ribbon of scholarship*—conferred by his *Alma Mater* on the same headmaster, it will be evident that Dr. Knight at any rate is doing his part to raise the true dignity of the profession he loves, and is well worthy a place of honour in the list of "Well-known Teachers."

The influence of Dr. Knight, especially on younger members of the profession, and the power of his example as an

DR. JAMES KNIGHT.

incentive to earnestness alike in study and in practical work, has been so marked that it may be profitable as well as interesting to give a brief sketch of his career. A native of Glasgow, Mr. Knight had a fortunate start in his calling by being apprenticed in the Cathcart Street School, the headmaster at the time being Mr. David M'Neill, whose strong practical interest in his pupil teachers was evidenced again and again, as well by their distinctions won in Science and Art as by their brilliant performances at the various Queen's Scholarship Examinations. James Knight worthily upheld the Cathcart Street traditions. His list of successes during his apprenticeship is worthy of record, comprising first-class Advanced Certificates (S. and A.) in Physical Geography, Physiology, Magnetism and Electricity, a first-class Society of Arts in French and in Music, a first-class Ewing Certificate in the latter subject and the G.T.S.C. degree, also the full "D" Certificate in Drawing. At the Training College Entrance Examination of 1878, Mr. Knight won the first place for Scotland, consistently holding his position at the close of each year of his training. His university course at Gilmorehill, Glasgow, was similarly distinguished, Mr. Knight being a prizeman in almost every class. Taking his M.A. degree in 1882, Mr. Knight continued his studies, and, winning the Hunterian medal by the way, closed his university attendance by graduating B.Sc. in 1884.

Thereafter, although reading liberally in modern French, German, and Italian literature, Mr. Knight devoted himself chiefly to his favourite study of physiology. Original research in the chemistry of foods, leading incidentally to the authorship of several text-books on the same branch of study, resulted in his thesis on "Infant Foods and Infant Feeding," which won for him his crowning academic honour. It is interesting to note that only twenty-eight out of the Glasgow University graduates' list of six thousand hold this coveted honour, and some half of these figure on the staff of professors and lecturers at Gilmorehill. Certainly, so far as we have been able to discover, the headmaster of St. James's is the only Doctor of Science among the headmasters of elementary schools in Scotland.

Mr. Knight's career as a teacher has been spent entirely in his native town, and shows a rapid rise on the professional ladder. Two years at elementary work in Greenside Street and Hozier Street Schools led to his transference to the Dennistoun School, where he came in touch with the headmaster, Mr. Donald, one of Glasgow's most successful teachers. Two years later Mr. Knight was appointed to the High School, where he taught for eight years, first in the English department, and later in that of Mathematics and Science, under the prominent educationist Dr. Muir. His next charge was the second mastership of John Street School, Bridgeton, an institution which, under the control of Mr. Paterson, has won an outstanding position in the educational life of Glasgow. Here Mr. Knight's work was exclusively in the Higher Grade department, for which his scholarly attainments so well fitted him. In 1899, the great year of the revolutionary Scottish Code, Mr. Knight was appointed headmaster of St. James's Public School, the sphere of his present activity. This school (with an accommodation of nearly 1,400) is situated in the Calton district, one of the humblest localities in the city, where every inch of progress has to be nobly and patiently fought for.

Here we found the subject of our sketch on the occasion of our visit, in his private room, hard at work, with class lists, examination papers, notes on individual pupils, arranged on his table with the orderly method so characteristic of the man. That private room, by the way, is a combined office, reception room, and surgery, besides serving as a small laboratory, where the specimens for the school museum and aquaria are prepared, doctored, or cremated, as the case may require.

The figures and notes on the class lists under survey provided a very natural opening of the interview on precisely the most interesting lines. The headmaster's intimate acquaintance individually with his pupils was delightful, his wonderful memory giving him here a great advantage over the average teacher. With the courteous brevity of the man who utilises sixty minutes of every hour, the principle of classification obtaining in the school was explained in answer to our inquiry. There are three independent lines of classification—namely, Arithmetic, Drawing, and English, the last of which may be said to include all the remaining school subjects. This system has been so successful in its work that it has been quoted by Mr. Scougal, H.M.I., in the Blue Book for 1900-01, as a "concrete example of admirable organisation." The time-table (uniform for all classes) also instanced in the same report is still adhered to, with a recent slight modification to suit a necessary change in the interval for lunch. The great difficulty of plural classification—namely, the inconvenience of frequent changing of class places—is entirely eliminated by the arrangement adopted. It will be seen that only on Tuesday and Thursday at two o'clock is there a change which does not concur with a playground interval.

We give the time-table in detail:—

* Doctor of Science, Glasgow University, October 1903.

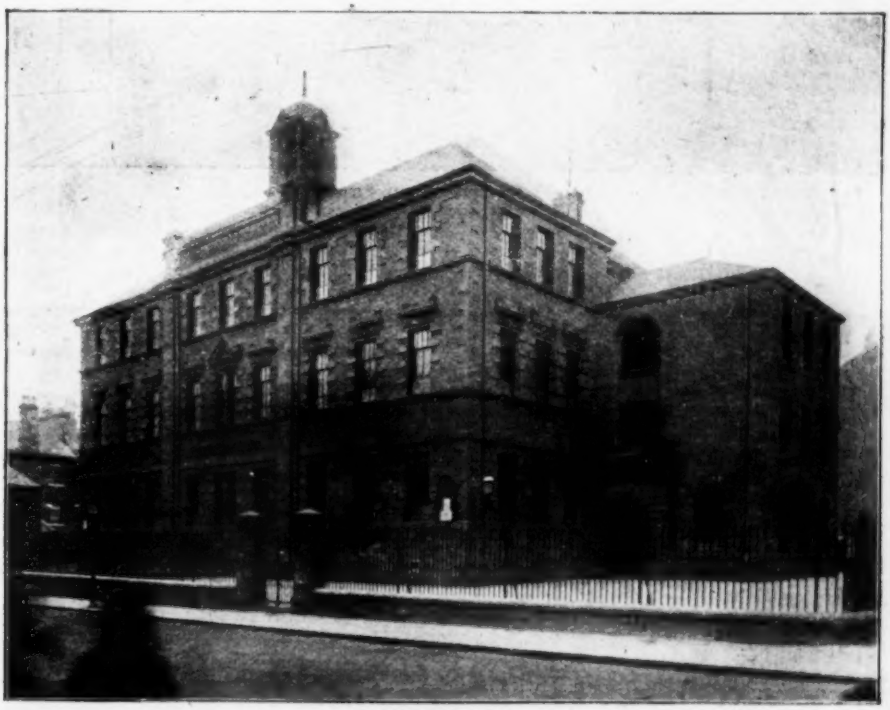
	9.15.	10.		11.	11.10.	12.15.	1.15.	2.	3.	3.10.	4.
M.	Bible.	English.		PLAYGROUND INTERVAL.	Arithmetic.	LUNCH INTERVAL.	History and Geography.	Writing.	PLAYGROUND INTERVAL.	Sewing (Girls). Arithmetic or Mathematics (Boys).	
T.	,,	Eng.	Music.		,,		Nature Knowledge.	Drawing.		,,	
W.	,,	English.			,,		History and Geography.	Writing.		,,	
Th.	,,	,,			,,		Nature Knowledge.	Drawing.		,,	
F.	,,	Eng.	Music.		,,		History and Geography.	Writing.		,,	

An examination towards the end of the school session in June determines the composition of the classes for the beginning of the next session. Thus not a day is lost on resuming after the vacation. A second examination at Christmas serves to rectify unjustified expectations, while the headmaster feels the pulse of the school by a third thorough examination about Easter.

In order to get some concrete facts out of the examination abstracts, we instanced at random a number of pupils, especially in the upper classes. This elicited further evidence of Mr. Knight's wonderful memory. Number 1 was a boy who had come from a country school three years ago: arithmetic strong—he would have been in the top class but for measles last spring; English deplorable at first, but progressing; great interest in nature knowledge; and fair in drawing. Similar familiarity with the career of the others showed that the headmaster was not content to know his pupils by registration and teachers' reports, but cultivated an acquaintance at first-hand. Altogether, these annotated lists, when humanised in this way, furnished a most interesting chronicle, and it was with reluctance that we left Dr. Knight's room to prosecute our tour round the premises.

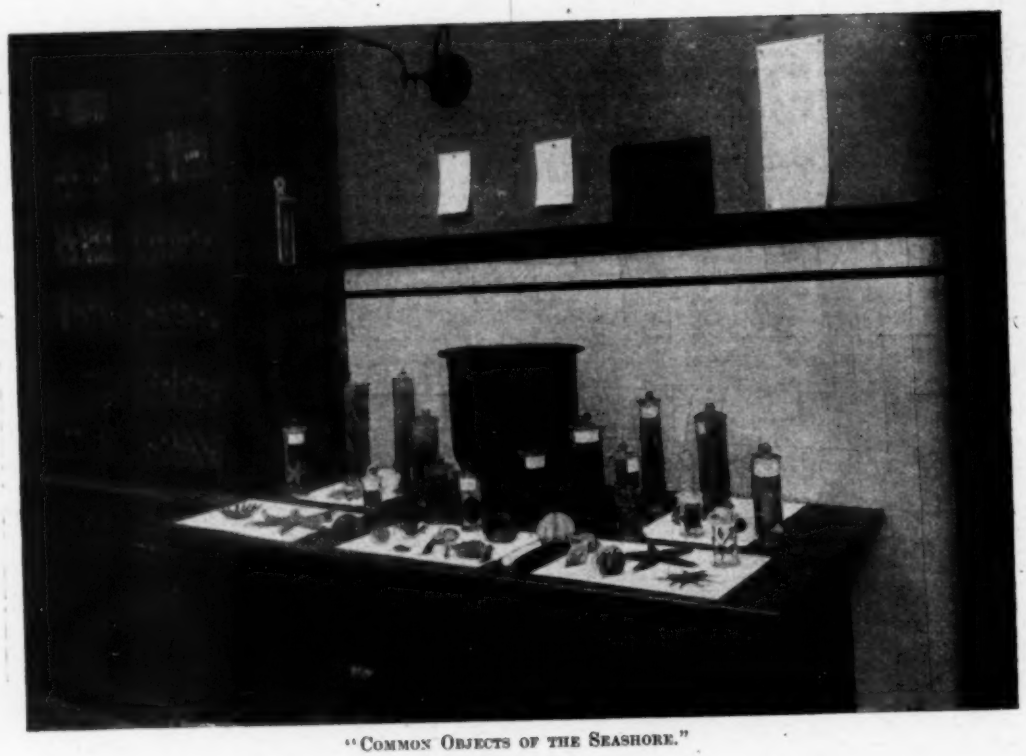
The building, which consists of three stories, lends itself perfectly to the usual three-fold division of the elementary school, the infants' classrooms being situated on the ground floor, and the junior and senior departments occupying the second and third stories respectively.

In the room which we visited on the first floor, the decks were being cleared for the lesson in "freearm" drawing, and we could not but remark the careful attention that was given to the subject. All round the classroom were displayed most creditable specimens of the children's work. Indeed the benefits of a course of training in this branch of the subject were here patent to the most casual observer.



St. James's Public School.

The walls of the school in general are hung with well-chosen pictures of interesting natural objects, prominent among which I remarked an excellent botany series representing the common flowers, and showing in clear type the English name in each case. The same practical common-sense is evidenced on the shelves of the valuable little museum, where the children learn to be familiar with, say, marine specimens, such as the sea urchin and the hermit crab, information which their elders pass by helplessly when presented in outside collections as "Echinus" and "Pagurus." The school possesses also fresh-water and sea-water aquaria,



"Common Objects of the Seashore."

The School Museum.

features of endless interest to the children, not a few of whom have a practical unassuming acquaintance with the inhabitants of these water worlds that would open the eyes of many a professed student of natural history. In this connection we should greatly like to devote space to an extremely interesting lesson which we were privileged to hear given by Miss MacCallum to a junior class on "Common Objects of the Seashore." But we must not trespass, and shall content ourselves by remarking that it was simply delightful to see how this subject became a means of deepening, broadening, purifying, and brightening the narrow lives of these town children, whose home circumstances in many cases have so little that is either interesting or elevating. We reproduce a photograph of Miss MacCallum's table with the specimens laid out, as these appeared at the close of the lesson.

Dr. Knight has all along been a strong advocate of the use of the lantern as a valuable aid in teaching, especially in revising the lessons in history and geography, and in nature knowledge. His facility in preparing slides and mounted specimens is wonderful, and the lantern under his manipulation lends to the lesson an interest and an impressiveness which it is almost impossible to overestimate. The St. James's session was but three months old, and already over a dozen lantern lessons had been given to grouped classes.

Another feature of great interest in the corporate life of the school is the rambling club. This is now co-ordinated with the supplementary course for boys, St. James's being the centre for the Calton district. These outings are a genuine attempt at realising the suggestions of the famous Circular 234 of the Scotch Education Department. Sometimes the main object of the excursion is historical, sometimes geographical, sometimes botanical, but *always* geological, and it seldom ends without securing a few specimens for the aquaria and the museum. The modern side of school work is further developed by actual lessons given sometimes in the People's Palace (the museum of East Glasgow), sometimes in one or other of the public parks. Even the infant classes have had their school lessons connected with the natural outdoor world by visits to the Alexandra and Tollcross Parks.

The harmonious relations existing between the headmaster of St. James's and his staff were fittingly evidenced a few weeks ago, when the second master, Mr. Harvie, on behalf of the staff, presented Dr. Knight with the D.Sc. robes and hood on the occasion of his academic distinction.

Dr. Knight, it is almost needless to remark, keeps himself fully abreast of the times in all matters connected with education; and this freshness, coupled with his strong power of initiative, counteracts in his school the tendency that besets the elementary class teacher to lapse into the mechanical discharge of duty in a narrow groove. At the same time there is no hindrance to originality in method; only such must be co-ordinated to the general working lines of the school. Doubtless a drone in the St. James's hive would speedily have the truth of his position brought home to him, and would be either transformed, or—at his own request, one would fancy—transferred.

Particularly worthy of note as a direct influence of Dr. Knight is the earnest attitude to continued study on the part of the class teachers of this school; and at frequent odd half hours throughout the week, at lunch-time or after school hours, a few of these lovers of culture meet with the indefatigable headmaster for study, chiefly in modern languages—timely-wise individuals who have early recognized that a teacher who ceases to be himself a student thereby severs one of the most vital links between his own nature and that of the child under his training. The same principle has led several of the staff, both ladies and gentlemen, to take a deep interest in natural science, with a view to equipping themselves for real teaching in nature knowledge. As a consequence, the lessons of these teachers contrast brilliantly with the too common superficial work in the subject. Certainly the complaint of one leading inspector, that "nature knowledge as a school subject is viewed with distrust if not dislike by not a few teachers," has no application to St. James's.

In extra-mural work Dr. Knight finds numerous channels of general usefulness. He is a director of the Millport Marine Station, a member of Council of the Glasgow Royal Philosophical Society, and a valued worker of many years' standing in Scottish Sabbath-school work. Though apt to be sometimes terse in language, as he invariably is in thought, the doctor is nevertheless at all times cheerful and affable in disposition, and to his stimulating influence and example of unswerving perseverance not a few young teachers owe their success to-day. We take leave of him here, then, as we did on the occasion of our visit, recognising the manly part he plays in the work of educating and generally elevating the part of humanity where his lot is cast; and our wish will doubtless be warmly echoed by our readers, that the active headmaster of St. James's may long retain that vigour, physical and mental, which, with his earnestness of purpose, renders him an ornament to his noble profession.

HEAD-TEACHERS' CONFERENCE AT SHEFFIELD.

ONE of the most interesting of the many interesting educational conferences held during the Christmas recess was that of the National Federation of Head Teachers. This was opened at the Pupil Teachers' College, Sheffield, on Tuesday, January 5, and lasted three days.

One very interesting feature was the statement that the Council was much gratified to report that cordial relations had been maintained with the N.U.T., the National Federation of Assistant Teachers, and the Association of P.T. Instructors. Representatives of those bodies, including a special deputation from the N.U.T., and Mr. J. J. Cullum, President of the N.F.A.T., were present, and spoke. As the Federation was originally founded for the protection and furthering of certain special interests, the cordiality shown to and by the deputations deserves special comment, as marking the preponderating influence of general over special interests in the present working of the associations.

The president, Mr. T. Thorpe, B.A., of Leicester, in his opening address, said the future hope of the State lay in the children of to-day, and those great cities which, like Sheffield, had developed their educational facilities, deserved well of the State. For outlay undertaken in this direction each town and district had the right to look for a direct and remunerative return in the shape of more intelligent workmen, more skilful artisans, more highly trained and expert foremen, managers, and manufacturers—the future leaders and captains of industry. England no longer enjoyed the prescriptive right to be the workshop for all the world. This was a century of fierce competition, and it was to better education, to the better training of our industrial population, that they must look for the devising and carrying out of more skilful, more economical, and more productive processes. Though education might not be the sole factor in this important question of commercial supremacy, it was one, at least, of the controlling influences. For the commercial and industrial advantage of the State there must be no limit set to any child's educational advancement. The great changes designed to take place in the administration of our educational system by the Act of 1902 were slowly being accomplished. The work of co-ordination was no light or easy task, on account of the numerous interests involved. But no interests should be permitted to override the one main consideration—that the interests of the child were paramount. As head-teachers they all welcomed with unalloyed satisfaction the recent issue of special regulations affecting the training of teachers, though much they should like to have seen was not even attempted. A perusal of the new regulations, and of the remarkable prefatory memorandum which accompanied them, would convince all that at last the training of the teacher was to be taken in hand seriously, and on thoroughly educational lines.

There exists between the pupil teacher and the fully-certificated teacher an army of no fewer than 36,000 ex-P.T.'s, besides 18,000 adult women sanctioned under Art. 68. And

the training of this accumulation of teachers who are untrained in any way would take the existing training colleges twenty years, even if every available place were reserved for the overtaking of these arrears. But the training of teachers is only a part of the problem; there is still the question of the supply. The teaching profession offers few inducements to suitable candidates to come in and remain in. In spite of the fact that there are over thirty secondary examinations qualifying for appointment as teachers in elementary schools, the Blue Book is forced to admit that "teaching in elementary schools does not appeal as a profession to those who can afford the expenses of their own higher education." Even with an education practically free, parents who can afford to keep their children earning next to nothing during the long period of pupil teachership and training-college course do not find the subsequent emolument lucrative enough to justify the choice of teaching for their children's profession. The question of wear and tear is an important factor, and Mr. Rankine estimates the average school life of a teacher after leaving college as only fourteen years.

Miss Cleghorn of Sheffield moved: "That this Conference views with regret the sanctioning by the Board of Education of the erection of a large number of barrack schools, and urges the Board to carry out its own regulations as to the size of schools."

An interesting discussion followed. Supporters of the resolution condemned large schools and combined schools, while others spoke of the advantage of large schools because of the possibility of carrying out a perfect system of classification.

In the end the resolution was put to the meeting, and twenty-five voted each way. A poll was demanded, and the result, which was declared the next day, showed that the resolution was lost by the small majority of 4 out of a poll of 4,972.

The meeting on the second day was favoured with two very interesting papers dealing with matters educational in other lands. Mr. H. Coward, the President of the N.U.T., gave an address on "Education in the Far West." He referred to the large and increasing numbers of ladies engaged in teaching, to the exclusion of men, and hoped the time would never come when such a change would be made in this country. Illustrating the public attitude towards the schools, he said if there were any weak points in the American system the Americans were not willing to tell them; so at home, he feared, we were too ready to find specks in the system, and to magnify them rather than to uphold the dignity of public education. He alluded to the zeal displayed by Americans for education, and also mentioned the advantages which resulted from the co-operation between the various public bodies managing the affairs of the different towns and the school authorities. The superiority of the American system need not put Englishmen into a panic; but at the same time the advantages enjoyed by education in America were bound to tell heavily in favour of that country in the near future. We could learn many things from America, and we could adopt their spirit for the benefit of the rising generation.

His remarks respecting the earnestness of the Americans on behalf of education were confirmed by Professor Ripper, of the Technical Department of University College, Sheffield.

Mr. J. H. Yoxall, M.P., alluded to the great attention now being paid in this country to what was going on abroad, and particularly in America and Germany. Those who felt that the great need of the English people was a more rapid appreciation and adoption of ideas, and not only more education, but more brains, could hardly sympathise with any proposals, administrative or legislative, which would surround us here with anything in the nature of a ring fence, which would attempt to make up for our slackness in the past by excluding us from outer communications, and to compensate for our lack of initiative by placing us still more in the rear of nations whose progress was due to their intellectual earnestness and swifter mental progress.

The poll for the election of members of the Council resulted in the success of Mr. J. W. Iliffe (Sheffield), Miss A. Stone (Nottingham), Mr. J. W. Stacey (Salford), Mr. R. M'Ivor (London), Mr. W. Taylor (London), and Miss Pickering (Liverpool). Mr. E. F. Farthing (London) was reappointed secretary, and Mr. F. J. Morgan (Birmingham) treasurer.

A series of resolutions was submitted by the Council on the subject of pupil teachers. The first expressed the opinion that school methods should form part of the curriculum of every pupil-teacher centre; next, that pupil teachers should attend one-third of their time during the first year and one-half in the second year for training in the art of teaching; also that, wheresoever practicable, technical training of pupil teachers should be conducted in schools especially staffed. It also called upon the educational authorities to improve the conditions under which ex-pupil teachers are prepared for certificate examination; and lastly, expressed the opinion that, unless greater inducements were held out, the supply of candidates for teaching would be further limited, especially in the case of boys.

Miss E. P. Hughes, late Principal of the Cambridge Training College, contributed a paper on "Educational Problems in the Far East." She expressed the belief that there was no gulf in humanity so wide or deep as that which separated the East from the West. It was found in every phase of life, but especially in the matter of education. In all Far Eastern countries education was advancing rapidly. One of the great difficulties was an overcrowded curriculum—a problem which caused some difficulty in England. (Laughter.) Another difficulty in Japan was the education of girls and women. The great desire of the Japanese to get knowledge resulted from the belief that only by getting knowledge could they help their country. One of the greatest problems in Japan was the question of English spelling. The absurdity of our spelling was never more realised than when one was teaching an intelligent foreign class. She could not understand why we did not reform our spelling. Unless we bestirred ourselves, the Americans would reform it for us. Japan was the one spot in the Far East that had never been conquered; and she believed it was absolutely unconquerable, although the millions of Russia might annihilate the Japanese soldiers if the world stood by and allowed it to be done.

In the evening a pleasant social function took place in the form of a welcome by the mayor in the town-hall.

JOINT CONFERENCE OF EDUCATIONAL ASSOCIATIONS.

UNDER the auspices of the Teachers' Guild an extremely interesting Conference was held on Monday, January 11, at the City of London School, and it is extremely gratifying to note how the different educational associations are willing to sink sectional differences—if they really have any—and unite in the effort to forward the real cause of education. The Conference, which was well attended by teachers from all parts of the country, was composed of representatives of the Assistant-Masters' Association, incorporated; the Association of Assistant-Mistresses, incorporated; the Association of Head-Masters, incorporated; the Association of Head-Mistresses, incorporated; the Association of Head-Masters of Preparatory Schools; the College of Preceptors; the Head-Masters' Conference; the National Union of Teachers; the Private Schools' Association, incorporated; the Teachers' Guild of Great Britain and Ireland, incorporated (with its allied societies, the Birmingham Teachers' Association and the Friends' Guild of Teachers).

The chair was taken at ten by the Rt. Hon. A. H. Dyke-Acland, under whose guidance several most interesting discussions took place; but it was decided that no resolutions should be put to the Conference, the object being to obtain an exchange of views. The morning session was devoted to the consideration of (*a*) the ages at which it is desirable that transition from primary to secondary schools, and from one type of secondary school to another, should be made; and (*b*) the extent to which the curriculum in one type of school

should be correlated with that in other types. The chief speaker on the last question was Mrs. Bryant, D.Sc., who read a very suggestive paper.

The afternoon session opened with a discussion of "the best method of discovering the child of scholarship form at the appropriate age for transition from primary to secondary schools." This was introduced by Professor Adamson, B.A., King's College, London, and many suggestions were made as to subjects for scholarship examinations, and the way in which these should be conducted. The general feeling seemed to be that more importance should be attached to the recommendation of the master of the school from which the boy came—in fact, some speakers urged that scholarships should be given on that alone.

This was followed by a discussion on "the best method of adjusting the elementary pupil-teacher system to secondary schools." This subject was opened by an interesting speech by Professor John Adams, M.A., B.Sc., of London Day Training College, who showed how the pupil teachers and the secondary schools might each benefit. He advocated a course of study in the secondary school from the age of twelve to seventeen and a half, including one term full time in an elementary school at about fifteen, and half a year at the end of that period to acquire a certain amount of instruction in the art of teaching. He was followed by Mr. George Collar, B.A., B.Sc., of Stockwell Pupil-Teacher School, who claimed that the present pupil-teacher centres should have been clearly stated in the "Regulations" to be secondary schools, since they are recognised as such by the "Cockerton Judgment," and by the Teachers' Registration Council; and he quoted the report of the Departmental Committee on the subject: "We look forward to the ultimate conversion of those centres, which are well staffed and properly equipped, into real secondary schools, where, although perhaps intending teachers may be in the majority, they will have ampler time for their studies, and will be instructed side by side with pupils who have other careers in view." It would not be educationally sound to keep intending teachers at elementary schools till fourteen, at secondary schools from fourteen to sixteen, at centres from sixteen to eighteen, and at training colleges from eighteen to twenty. They should leave the elementary schools at about twelve, and continue at the secondary school till they go to college, the last two years to include a certain amount of technical training. The teaching profession had drawn very few recruits from the present secondary schools—the attractions are not sufficient to induce those to take up the work who can pay for their own training; but how is the cost to be met? The elementary rate cannot be used; and if the charge falls on the secondary education fund, in many places there will be none left for other forms of secondary education. It must be met by an increased Parliamentary grant.

As the next nominated speaker was unable to be present, the Conference had the pleasure of hearing the president state his views on the subject. He was heartily in accord with the last speaker, and said that those pupil-teacher centres which were well equipped should be regarded in every way as secondary schools, and should provide a course for pupils from twelve up to seventeen or eighteen. He regretted that the elementary school fund could not be charged with the cost of carrying on work from which elementary education would derive so much benefit, although unquestionably the work itself was secondary.

Mr. Trevor H. Walsh, B.A., Assistant-Secretary of the Kent Education Committee, spoke from the administrative side, and said that this subject was of such far-reaching importance that it was a pity that the whole of the morning session had not been devoted to it.

Miss Manley, Principal of Stockwell Training College, also spoke on the direction in which the education of pupil teachers should be conducted.

By the kindness of the Skinners' Company, those members of the Conference who were members of any of the participating associations were invited to a conversazione at Skinners' Hall, where a very pleasant social evening was spent.

NOTES AND JOTTINGS.

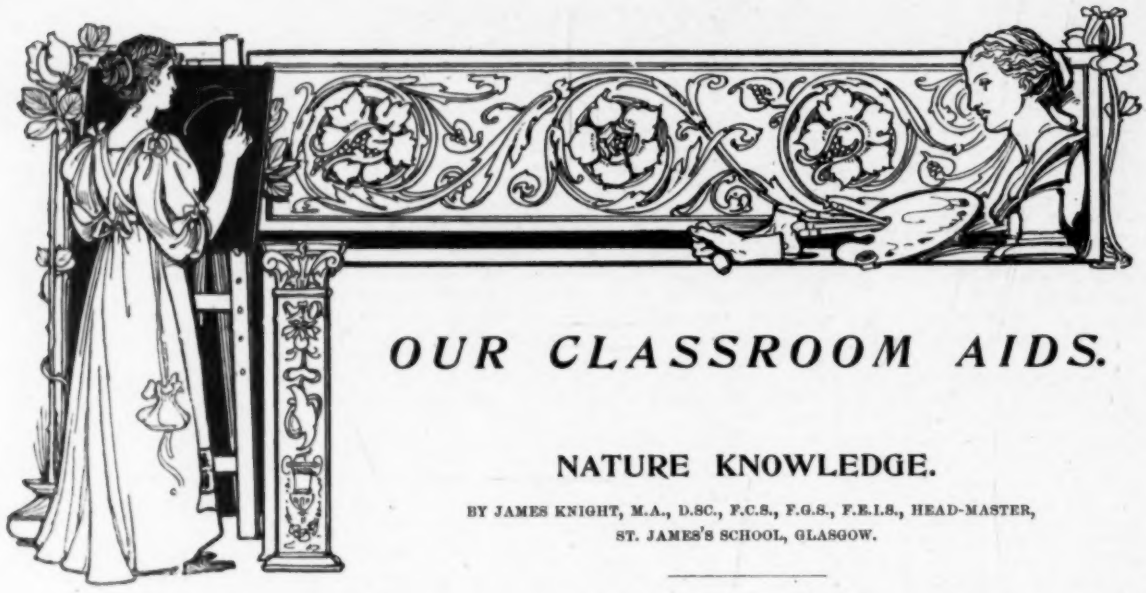
CHURCH SCHOOLMASTERS' AND SCHOOLMISTRESSES' BENEVOLENT INSTITUTION.—A Conference of the Executive Committee and the local secretaries of this institution was held on the last day of the old year and the first of the new, and under the chairmanship of Mr. W. T. Berry a large number of representatives gathered at the National Society's offices. It was decided to pay all future orphan allowances until the orphan reaches the age of fifteen. After a discussion on the best means of securing the election of really deserving candidates, although they might not have some of the strong local boards of subscribers to support them, it was decided to empower the council to elect four of the unsuccessful candidates instead of two as at present. It was also decided to take steps to make the Provident Annuity branch of the society's work more widely known. This is in such a sound condition that a government annuity could be purchased for each annuitant, and yet leave a balance of £1,500 in hand. In considering the financial position of the Institution, it was announced that £475 had been raised by the "West Country Special Effort," and it was decided to make a special appeal to the clergy for offertories.

EDUCATION IN CEYLON.—Mr. A. G. Wise, formerly a planter in Ceylon, writes to question the accuracy of a statement, attributed to Sir West Ridgeway in our issue of December 12, to the effect that educational facilities have been provided on all tea estates in Ceylon. Mr. Wise states that, as a matter of fact, only forty-three schools have been founded. The number of plantations is 1,857, and the number of children attending the schools is 1,840, or rather less than one child per estate. In a few instances small informal classes have been started by individual native overseers, or "canganies;" but these classes are, as a rule, attended merely by the children belonging to the cangany's own gang, and are of no service to the other children on the estate. "What is therefore required," Mr. Wise adds, "is a school, under government supervision, on every plantation or group of plantations. Until such schools are established by law the coolies will continue in their present condition of dense ignorance, an easy prey to all kinds of sharpers, and their state will remain a source of discredit to the local government as well as to Great Britain."

THE SCHOOLMASTER'S YEAR BOOK AND DIRECTORY, 1904.—Messrs. Swan Sonnenschein and Co. are to be congratulated on the fact that their venture of last year has proved so successful that they are able to continue the issue of this valuable year book. In a work of such magnitude a few errors were inevitable in the first issue, but these all seem to have been corrected in the present volume, and very many additions have been made. There seems to be no point connected with education on which this book does not afford reliable information, and it is indispensable for all educational authorities, and extremely valuable for parents and others who are interested in the subject.

The educational work of the past year is fully and clearly recorded in the "Review of the Year" and in the "Chronicle of the Year." Full particulars of the various educational societies and organisations are given, together with detailed accounts of the university and other public examinations, and of the educational books published during the year. The second part consists of a detailed directory giving the names of no fewer than 9,000 masters in secondary schools, and a list of 1,200 secondary schools for boys.

THE NEW EDUCATIONAL AUTHORITY FOR LONDON.—The London County Council election will take place on March 5th next, and the Progressive Party have declared the policy they will adopt with regard to education. They state that if they are successful in securing a majority they will take over the administration of education from May 1st, which is the earliest possible date. They also declare that the education committee must consist of elected members of the council, except that a few women and a few members of the present School Board (probably four in each case) will be co-opted. The representatives of interests, either sectional or sectarian, will not be asked to join. Some twenty or five-and-twenty members of the School Board will probably offer themselves for election on the County Council, in order to work on the education committee.



OUR CLASSROOM AIDS.

NATURE KNOWLEDGE.

BY JAMES KNIGHT, M.A., D.SC., F.C.S., F.G.S., F.E.I.S., HEAD-MASTER, ST. JAMES'S SCHOOL, GLASGOW.

LESSONS ON FOODS: FATS.

THE chemistry of soap-making, as explained in the January number of the *Practical Teacher*, is the key to the digestion of fatty foods. In the case of carbohydrates it has been seen that digestion begins in the mouth, is to a large extent suspended in the stomach, but resumed and completed in the small intestine, resulting in the conversion of all carbohydrates into dextrose or grape sugar. Any text-book of physiology will give the subsequent history of these foods, showing how this dextrose passes into the veins of the digestive canal, thence through the liver and "portal system," reaching the right side of the heart from below. With fats it is different: they are not affected in the mouth or the stomach, except in so far as they are liberated from the cells containing them. It is only when they reach the small intestine that fat digestion begins, owing to the action of a ferment which splits fats into glycerine and fatty acids. These seem to be absorbed either as they stand or with the acids converted into soluble soaps; but in the process of absorption reunion takes place between the glycerine and acids, so that very fine globules of fat are re-formed, as if the splitting above mentioned were merely a device to secure their absorption. Further, these oil globules are found, not in the veins at all, but in the lacteals, the lymphatics or drainage-tubes of the intestine, and their subsequent course to the heart is not by the portal vessels and the liver, but by the thoracic duct to the right side of the heart, which they enter from above. It is interesting to see that the constituents of a piece of bread and butter thus travel together till the small intestine is reached, where they part company—the starch, sugar, proteids, and other constituents of the bread proceeding *vid* the liver, and the butter fat proceeding *vid* the thoracic duct—meeting once more in the right side of the heart, which they have approached from opposite directions. The course may be exhibited in diagram form:—

	Mouth.	*Stomach.*	*Intestine.*		
Food. Fats			Fatty Acids, Glycerine	Fats *vid* Thoracic Duct	Right Heart.
Carbohydrates	Dextrin and Maltose		Dextrose		Right Heart.
Proteids		Peptones		Albumen *vid* Liver.	Right Heart.

This digestion of fats may be shown artificially. Shake up some olive oil with a little carbonate of soda (soda-ash) and ether, so as to form a neutral fat. Use excess of oil; this will float on the white mass, and it may be poured off or removed by a pipette. Now add to this pure fat some extract of pancreas, such as Benger's Liquor Pancreaticus; add a little blue litmus as a colour test, and keep the whole at blood heat for two hours. At the end of that time the blue colour will be replaced by red, showing that acids have been liberated. Ordinary fats and oils always contain some free fatty acid, hence the necessity for shaking up with alkali to remove this. The pure neutral fat left may be dissolved in ether, separated by decanting from the white soapy mass, then allowed to evaporate.

What is the source of body-fat? It is true that if an animal is starved and then fed on foreign fats—for example, a dog fed on suet—some of the foreign fat is deposited in the body unchanged; but in ordinary nutrition the fat stored up is not the same as that eaten: a man feeding on fat beef or mutton does not store up tallow or suet, but human fat, which is chemically distinct. The main source of fat seems to be carbohydrate and proteid foods. In many seeds fats and oils are formed during the process of ripening at the expense of the starches and sugars originally present in them. Cattle-feeders are well aware of the fattening properties of starches and sugars. The ripening of cheese is an example of fat-formation from proteids; so is fatty degeneration of muscle tissue, and the accumulation of fat by the larvæ of blow-flies fed upon exclusively proteid matter. Another proof is at hand in the increased richness of milk in cream in the case of nursing mothers when a proteid diet is used, so that an exclusive diet of lean meat gives a milk exceptionally rich in cream.

Fat is thus formed out of any food stuff, and stored within certain parts of the body as a reserve stock of heat and energy generally. Fats contain about 79 per cent. of carbon and 11 per cent. of hydrogen, and have thus a high value as heat-producers. In cold weather we instinctively increase our allowance of fats, while in high latitudes the diet is positively oily, to an extent that would be disgusting here.

The percentage of fat in food varies very considerably. Food stuffs containing fat may be conveniently arranged under four heads—first, milk and milk products; second, flesh meat and other sources of "visible" fat; third, fish, in which the fat is diffused throughout the flesh; fourth, vegetable sources of supply, chiefly cereals and legumes. The following table, modified from Parkes, gives representative food stuffs in each class, with the percentage of fat:—

1. Milk (cows'), 3·7 to 4; cream, 26·7; skim milk, 1; separated milk, 0·1; buttermilk, 1·5; butter—fresh, 85, salt, 80; margarine 82; cheese, 6 to 40; skim-milk cheese, generally below 25; whole milk cheese, 35 to 40; cream cheese, 40 to 80.

2. Beef—lean, 3·5, medium, 8·4, very fat, 19; mutton—medium, 5·77, very fat, 25·61; pork—lean, 6·81, fat, 37·34; dried bacon, 73·30; smoked ham, 36·5; tinned meat, 11·5; poultry, 3·80; goose (fattened), 45·5; veal—lean, 4·41, fat, 7·20.

3. Fish.—Whiting or other white fish, 2·9; sole, 0·25; salmon, 5·50; herring, 7·11 to 9; salt fish (cod), 0·39; eels, 13·8 to 28·5. Note the great wealth of fat in eels, which are nevertheless very digestible.

4. Vegetable fats.—Flour (wheaten), 1·2 to 2; wheat, 1·70; barley, 2·12; barley meal, 2; oats, 6; oatmeal, 5·65; rice, 0·69; maize, 4·76 to 6·7; maize meal, 3·8; peas, 2·00 (average); beans, 1·6 to 2·3; other vegetables, 0·5 or less; cocoa powder (Dutch), 13·61; French chocolate, 20. Note here the high position of oatmeal—*pace* Dr. Johnson—compared with wheaten flour; also the extraordinary richness of cocoa and chocolate.

BIRD PRESERVATION.

EDUCATION in its various forms has unquestionably become the greatest humanising agent of the present day, and is now considered the panacea for every social evil. No doubt it is; but it must be the right sort of education, not merely secular—that of the "head"—but rather that of the "heart." Sir John Gorst once stated that the schoolmaster had probably more to do with the moulding of the character of the young than even the parent had. It is to the teachers of our youth, in both public and private schools, that we must look in order to secure better feeling and more sympathy amongst children towards what we are too often accustomed to term the "dumb animals." Birds are not really so, for they *can* speak to those who care to try to understand their language. At least so thought St. Francis of Assisi!

In this, as in other present-day problems, it seems that no real progress will ever be made unless we reach those of young and tender years. They are to become the future men and women, and their lives are more easily moulded in the right groove when they are at school than afterwards. It is easier to bend the tender sapling than the mighty oak, which too great a strain may cause to snap asunder. The advocates of the temperance movement grasped this idea long ago, and efforts were made by various temperance societies, U.K.A., and others, to impress upon children at school the evils attendant upon intemperate habits. The results have exceeded all that was anticipated of such action.

The practice of bird-nesting in the spring months, and the wanton destruction of bird life for the sake of sport, are still far too prevalent in this as in other countries. The problem of bird-protection has demanded a solution on the other side of the Atlantic; but in this, as in other great efforts, we have been anticipated by our American cousins. The late Dr. Northrop (1817–98), after making a lifelong study of the subject, concluded that the foundation of an "Arbour Day" was the best possible means of counteracting the temptation to destroy harmless birds and their little nest-eggs. The scheme which has been adopted in American schools works well enough, and should suit English schools if modified according to their requirements. Such a reform in our system of education appears to be excellent as well as feasible. At any rate, no better plan has yet been devised for the proper training of youth in habits of sympathy for our winged songsters. Children, as a rule, delight in the observance of a festival or day of rejoicing in connection with their school enterprises. "Bird and Arbour Day" seems to supply such a want. Its adoption generally would have the inevitable effect of refining English manners and customs.

Teachers in our public elementary schools can exert much influence by the impression of kind and sympathetic habits in the treatment of birds upon those committed to their care. Under the new scheme of "nature knowledge," recommended by the Board of Education, teachers have manifold opportunities of taking their pupils for long walks and rambles in the country. They can in this way teach both boys and girls many important facts about birds and their eggs, their names, colours, and other qualities. The habits of each particular bird, the kind of food necessary to its existence, and its practical use in the great plan of nature, should all in turn be explained to the children. The teacher may also, by his own example, show children the proper kind of treatment birds require. For this purpose a few pigeons with nesting-boxes may be kept in a convenient part of the school playground. The true lover of birds is he who is most assiduous in acquiring a knowledge of their haunts and habits, as well as in watching them in the full enjoyment of their liberty. It is by such means alone that a real knowledge of "natural history," so essential in education, can ever become widely diffused.

This, according to the poet Wordsworth, is the true key to learning:—

> "Books! 'tis a dull and endless strife;
> Come, hear the woodland linnet.
> How sweet his music! on my life
> There's more of wisdom in it.
>
> "And hark! how blithe the throstle sings!
> He, too, is no mean preacher;
> Come forth into the light of things,
> Let Nature be your teacher."

The eye must, however, be appealed to as well as the ear. Every school should possess pictures of the different birds and their eggs. ("Colman's" issue a fine set of cards which may be had for the asking.) These would be most useful to the teacher for purposes of illustration when giving object lessons. The wearing of badges bearing the picture of a bird should also be encouraged. A copy of the poem, *Peace and Goodwill to the Birds*, written by the Poet-Laureate, with painting (in card form, price 3d.), should adorn the walls of every school. School managers should also encourage their teachers to adopt as school readers, in the upper standards, the publications of the "Birds Protection Society." The leaflets published by the society form excellent practice, and are exceedingly cheap, the price varying from 1s. to 5s. per 100. The *Chart List of Birds* (price 1d.) which have secured protection, and a short printed summary of the *Birds' Charter*, should be hung on the walls of every rural and urban school.

For purposes of recitation, as required by H.M. Inspectors of Schools, there is no better plan than to adopt poems on birds, from the works of our foremost English poets, the words to be learned and repeated at least twice a week, and all necessary explanations of difficult passages given by the teacher. A list of such poems should include the following:—Alfred Austin—*Peace and Goodwill to the Birds;* Shelley—*Ode to a Skylark;* Longfellow—*Birds of Passage, The Emperor's Bird's Nest, The Bird and the Ship, The Birds of Killingworth;* Wordsworth—*The Green Linnet, To a Skylark, To the Cuckoo;* Edgar Allan Poe—*The Raven;* Cowper—*The Faithful Bird, The Jackdaw, The Parrot, The Swallow, Invitation to the Redbreast, To the Nightingale, Lines on a Goldfinch starved to death in his cage, Sparrows self-domesticated in Trinity College, Cambridge;* Milton—*Sonnet to the Nightingale;* Lewis Morris—*On a Thrush singing in Autumn;* Robert Leighton—*The Bunch of Larks;* William Blake—*The Birds;* Keats—*Ode to a Nightingale;* Walt Whitman—*Birds of Passage;* Coleridge—*The Nightingale;* Tennyson—*The Dying Swan, The Blackbird, The Throstle, The Song of the Wrens.*

The Penny Poets for School and Home, edited by W. T. Stead, and the *Canterbury Poets*, contain most of the above.

EUROPEAN EXPANSION.

ONE of the leading political ideas which the statistics of last century suggest is the prodigious rate at which the civilised world is growing. The population of Europe, and of nations of European origin, such as the United States, may now be fixed at something over 500 millions. The economic development of the people has been still more marvellous. The wealth of Europe, all told, which would probably not have been reckoned at more than £5,000,000,000 at the beginning of the nineteenth century, must now be reckoned by tens of thousands of millions.

The development among the European populations cannot, however, be said to have been uniform. It has been most marked in the Anglo-American section, the increase being from a population of not more than about 20 millions

to a population of not less than 130 millions at the present time. Russia and Germany also show remarkable increases, but nothing like this. Such an astonishing growth of population must necessarily mean a great change in the relative position of the European nations in the world and their relative weight in international politics.

The non European races of the world have all the time been practically stationary except in India, where the *pax Britannica* has permitted the native population to expand. This result is due chiefly to the fact that the forces of civilisation, as against those of the black and yellow—Japan excepted—races, have become well-nigh irresistible. Relatively speaking, the number of inhabitants per square mile of Europe is far greater than ever it was before, and the economic force of the leading powers has increased immeasurably. Whilst the United Kingdom, Germany, Russia, Japan, and the United States have all grown enormously, France and Austria have, in comparison, remained stationary; so that there are to-day only five great world Powers—namely, the United States, Great Britain, Russia, Japan, and Germany, with France a doubtful sixth.

The extent of the revolution that has taken place in the course of the last century obviously accounts for much that is going on in international politics. If the forces now in existence continue to operate for only a few more generations as they have been doing in the past, the close of the present century must witness a further transformation, the beginnings of which will be apparent in the lifetime of some amongst us. It is, therefore, a reasonable probability that unless some great internal change should take place in the ideas and conduct of the European races themselves, the population of 500 millions will in another century have become one of 1,500 to 2,000 millions. Whilst international politics will be more and more limited to the affairs of what are already the five Great Powers, further progress will depend upon the redistribution of power among the European nations, not only in Europe itself, but also in the Far East.

NOTES OF LESSON ON THE OWL.

Time taken.—An hour.

Class.—Standard III. or IV.

Object.—1. To induce habits of observation and to train power of deduction. 2. To stimulate the love of living things inherent in children. 3. To lead children to see that every creature is fitted for its place in the economy of nature.

Apparatus.—If possible, a live owl should be used to illustrate the lesson; but if this is not obtainable, then a

stuffed specimen or a picture must be used. In the country the children would observe the habits of the owl in its native haunts.

The Five Points.

I. **Preparation.**—Let the children carefully examine the specimen or picture; then by judicious questioning ascertain the results of their observations. Encourage the children to relate anything connected with the subject that has come within the range of their own experience. In this way the following facts will probably be elicited:—

The owl is a bird with round face, large eyes, hooked beak, large wings, and strong, sharp claws. It hunts at night time, catching mice, voles, etc.

II. Presentation.

The most characteristic features of the owl are:—(1) Its face; (2) its beak; (3) its feet; (4) its wings.

1. *The Face.*—The round, flat face, with its staring eyes and solemn expression, has led people to regard the owl as the bird of wisdom.

2. *The Beak.*—The beak of the owl is strong, curved, and sharply pointed. This hooked beak is characteristic of birds of prey, enabling them to hold their struggling victim quite firmly.

Foot of Owl.

3. *The Feet.*—The shape of the feet shows that the owl belongs to the class of birds known as "seizing" birds.

There are four toes, each armed with a strong claw. The outer toe is reversed, thus enabling the bird to seize the animals and birds on which it feeds.

The legs, which are short and stout, are covered with feathers up to, and sometimes over, the toes.

4. *The Wings.*—Let the children note the following points about the wing:—(1.) It is jointed like a man's arm. (2.) It is arched, being convex above and concave beneath. (3.) It terminates in quills, which although extremely light are wonderfully strong, thus considerably increasing the size of the wing without adding much to its weight.

Habits and Food.—Owls build their nests, which are rude, flat structures, in barns, ruins, and hollow trees. At night the owl issues forth in search of his prey, which consists of

III. Association.

Point out that in the same poetical manner the ancients regarded the dove as symbolical of peace, and the raven was always supposed to foretell misfortune.

Compare the bill of the owl with those of other birds, and show how, in every case, the bill is adapted to the special needs of the bird. Thus the duck has a broad, spoon-shaped beak, with a number of horny ridges; the woodpecker has a long, stiff bill for groping about in the rotten wood for worms; birds that live on seeds, such as the sparrow or bullfinch, are provided with strong, hard bills; while those that live on insects and berries, like the robin and swallow, are soft-billed.

Show the similarity between the feet of the owl and those of other members of the raptorial family, such as the eagle and the hawk.

Compare this prehensile foot with the foot of a barn-yard fowl, where the fourth toe is merely a stump. Compare the reversed toe to the thumb on the human hand, and show how impossible it would be to grasp anything firmly without a thumb, which moves in the opposite way to the fingers.

Let the children deduce from this that the owl seldom settles on the ground. Feathers are such terrible things for mud and wet to stick to that birds' legs, as a rule, are covered with scales instead of feathers, thus enabling them to run about in dirty places without the mud and dirt clinging.

Let the children compare for themselves this similarity between a bird's wing and a man's arm—the three joints of the wing corresponding to the upper arm, the forearm, and the hand. The fingers have, however, disappeared from the "hand," and it has become a stump, in which the quills are inserted. Compare the stroke of a bird's wing with the stroke of a man's hand in swimming, and show the importance of the wing being arched to make the necessary difference between up and down strokes.

II. Presentation.	III. Association.
mice, voles, beetles, and sometimes fish. These it seizes with its strong talons, and after crushing them to death swallows them whole. In the morning the owl retires to his nest in some dark corner, and spends the day in sleep while he digests the animals he has captured, casting up the bones and indigestible parts. An examination of these pellets shows the vast number of mice and other small animals consumed by the owl, thus protecting the farmer from a terrible scourge.	

IV. **Formulation.**—The owl was always regarded by the ancients as the bird of wisdom. It belongs to the family of "seizing" birds or birds of prey, and is, therefore, furnished with strong claws formed for grasping, and stout, hooked beak for holding and tearing its prey.

The owl feeds on mice, voles, etc., swallowing them whole and casting up the bones in little pellets.

The owl is of great service to the farmer in keeping down mice, voles, shrews, and other destructive vermin.

V. **Application.**—Having seen how the various parts of the owl are fitted for its particular habits and mode of life, encourage the children to follow up this point in regard to other animals.

THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

THE educational outlook for 1904 is very promising. All the authorities in the counties and boroughs are either well at work or just about to start. In some counties great pace is already being made. Here and there temporary difficulties have had to be met. Secretaries, surveyors, inspectors, attendance superintendents, and newly-appointed managers in places almost jostle one another in the playgrounds. Superhuman efforts are being made to deliver pens, blotting-paper, and exercise-books. Here and there schools have been absolutely without materials—for a time. Across the marches certain Celts are trying to starve the schools. A *mandamus* will soon cool their enthusiasm. The day of the schoolmaster has at length dawned. Education has come to stay.

Training of the Teachers. The first and most important work to be undertaken is the training of the teachers. The untrained master or mistress will gradually be squeezed out. The elementary teachers as a profession have already anticipated events, especially in London. (See statistics of the London School Board relative to the number of teachers in their employ holding university degrees.) It is not difficult to imagine a near future in which the majority of the elementary teachers will be university graduates. I strongly advise all young teachers fresh from training colleges to do their utmost whilst in the heyday of youth to qualify for the hood and gown. It only means three or four years' hard study. They will be well repaid afterwards.

Pupil Teachers should Matriculate. Pupil teachers who have opportunities should read for the Matriculation Examination instead of the King's Scholarship. By obtaining a first division in that examination they are excused from the King's Scholarship Examination. A pupil teacher who matriculated six months before entering college ought to be able to graduate in his second year or in the year afterwards.

The Choice of a Degree. In considering what particular degree you will read for, some attention must be paid to one's predilections. If, however, you are at all scientifically inclined, don't hesitate to go in for the B.Sc. The B.A. degree is fairly frequently met with nowadays. Not so the B.Sc. or the LL.B. The LL.B, though pretty looking, is unpractical. From the teacher's standpoint the B.Sc. is *par excellence* the most practical course. Moreover, science training is being demanded all over the country. Be wise in your generation, therefore, mindful of the old Persian epigram, "The stone that is fit for the wall lies not long in the road." I shall be pleased to help any readers by advising them as to the best course to take up in their particular circumstances. Any who write to me will oblige by giving, in as concise a manner as possible, their educational history up to date.

The L.L.A. for Ladies. With regard to lady teachers who feel unequal to the stress of the B.A., B.Sc., or LL.B., I can only recommend them to study for the St. Andrews L.L.A. This degree is by no means difficult to attain, provided the teacher is determined and able to apply herself fairly well to study. There is a distinct future for all elementary teachers who possess degrees, notwithstanding the fact that some authorities are apparently undervaluing them. I cannot regard the offer of £10 extra to a graduate as anything but a matter of undervaluing.

The "Notebook" Query Column.

Letters intended for this column should be addressed "Inspector," care of Editor, *Practical Teacher*. Only in very urgent cases can replies be sent by post, and then only when two stamps accompany the letter.

Doubtful obtained a position in the first-class at the King's Scholarship Examination, 1901, but has been prevented from going to college. He asks, "What is and will probably be in the future the status of an untrained certificated master? Is there an equal chance for certificated masters trained for one year and those trained for two years in obtaining posts?"

Answer.—I feel convinced that the untrained male teacher will, in the near future, be quite out of the running. My advice to "Doubtful," and to all others similarly placed, is to get a training of some sort. The county authorities will very shortly take up the matter of teachers' training. A training for one year is infinitely better than no training at all. At present persons so trained stand almost equally with the fully trained.

G. B. is desirous of casting aside the chalk and duster and entering the Civil Service. He is trained, and has his parchment. Will he have to repay the £75 or £100 grant by the Government in connection with his college career?

Answer.—I am afraid I misled G. B. in my reply through the post. Since then information has reached me to the effect that he will have to repay the sum on entry into the Civil Service.

J. C. passed London Matriculation in June 1903, Division I. He also sat at the King's Scholarship Examination last December. Will he be eligible to take the Certificate Examination in 1905?

Answer.—Yes. The time will be reckoned from the Matriculation Examination.

Riada desires to know how to become qualified to teach in a primary infant school.

Answer.—If you will write to me again, giving me some information as to your age and previous education, I shall be in a better position to give you advice. If you are over eighteen, you could probably procure a situation as an Article 68 (see Education Code published by Eyre and Spottiswoode), and could then study for one of the examinations named on pages 40 and 41, any one of which would qualify you as an assistant teacher. There are many institutions in London which prepare rapidly and successfully for such examinations. (See the advertisements in either the *Practical Teacher* or the *Schoolmaster*.) Write to me again.

Syzygy is a rural pupil teacher who has designs on the London B.Sc. and higher school teaching. He asks whether he can enter a secondary school after leaving the training college.

Answer.—I advise him not to trouble about secondary teaching until he has passed through the training college. To men with the London B.Sc. degree there will be numerous good posts open in higher elementary and technical instruction work.

ILLUSTRATIONS.

BY ARTHUR LEYLAND,
Pupil Teacher Centre, Water Lane, Stratford.

THE best sermons, the best moral and philosophical treatises, the best lessons, are those which abound in apt illustrations. The human mind delights in comparisons and analogies; hence the thrill with which one reads of the dead Duncan that "after life's fitful fever he sleeps well," or of Lucy that she is—

> "A violet by a mossy stone,
> Half hidden from the eye."

And good similes and metaphors are not only pleasing; they are often illuminating. When you have compared the majestic motion of the earth round the sun with the path of a stone which is attached to a piece of string and whirled round a boy's hand, you have brought a sublime truth within the grasp of a small intellect. Teachers do not, as a rule, press into their service half so many illustrations as they might do. They use those which are ready stuffed and mounted for them in the text-books, but they do not themselves hunt for them. Yet the search for illustrations is most interesting, and profitable to class and teacher alike. I always found it difficult, in teaching elementary science to Standard VI., to demonstrate clearly the three modes in which heat may be transmitted, until one day I made ten boys stand in a row, and asked the first boy to "transmit" in three different ways a tennis ball to the last boy. This he accomplished first by passing it to the second boy, who passed it to the third boy, and so on to the end; secondly, by walking to the last boy and taking the ball with him; and thirdly, by throwing the ball. The class had only to imagine that their fellows in front were molecules and the ball was a unit of heat, and they had grasped the ideas of conduction, convection, and radiation. Other truths, such as the fact that there are good and bad conductors, and that radiation is independent of intervening media, were taught as easily and as effectively.

What teacher of geography has not experienced great difficulty in explaining the direction of the trade winds? Children, and even pupil teachers, usually find it most difficult to understand that if the earth rotates rapidly from west to east and a wind is travelling less quickly, the latter will, so far as the earth is concerned, tend to take an opposite direction. But if at any time he happens to be travelling in a fast train when it passes a slow one and he fixes his gaze upon the latter, he will find it almost impossible to believe that it is *not* going in the opposite direction. Let him vividly describe that experience to his class, and he will have no further trouble with trade winds. Railway trains are rich hunting-grounds for the observant collector of illustrations. Would you have your duffers know and remember something of inertia? Then describe, with lively humour, the adventures of a youth who rises incautiously from his seat when the train is on the point of stopping, and who is precipitated into the lap of a neighbouring passenger.

I came back from my last summer holiday with a good haul. Once I wanted to prop open the door of my bathing-van. The weight of my boot was not sufficient to do this when placed against the middle of the door, but it was sufficient when placed at the corner of it, thus affording a capital illustration of the fundamental principle of the lever. On another occasion I was watching some swimming-matches. Three boys stood on a plank, a considerable distance from me, ready to dive. Suddenly they plunged simultaneously into the water, and a moment afterwards, apparently, the gun went off. This incident will be useful when I wish to teach that light travels more rapidly than sound. I read, too, in one of those ladies' papers which sandwich encyclopædic information between sentimental stories and advice to lovers, that a good way to prevent vases being tipped over is to fill them with sand. For a moment I longed to be back with a class to which I had been trying to demonstrate the principle of centre of gravity, that I might educe from them the fact that if the vases were only half filled with sand the tendency to get upset would be still less.

Not long ago my Euclid class insisted on forgetting the number of the axiom, "The whole is greater than its part." But in a moment of mad inspiration I attached to the body of the 9 a rough sketch of the head of a cat, and transformed the axiom into, "The cat is greater than its tail." Not once since then has any boy forgotten the number of that axiom.

Even rules of composition may be more easily remembered by means of illustrations of a humorous type. An occasional dose of this sentence will do much to cure the ambiguous use of the personal pronoun—"If the puppy will not eat the food, boil it." When you wish to impress upon a class the importance of commas, write this on the blackboard—"The teacher says the boy is an ass." Then ask a scholar to put a comma after "teacher" and one after "boy." His interest will be aroused (and probably his sympathy too), and his memory thereby strengthened. Or you may take the well-worn—"Cæsar entered on his head, his helmet in his eye, an angry glare in his hand, his trusty sword saying nothing."

When you are tired of collecting picture postcards, try collecting illustrations. You will find it more interesting, more profitable, and much less expensive.

A word ought to be said about the illustrative sentences which are offered to us by the children. Boys delight in horrors. Like Helen's babies, they revel in anything "bloogy." If you ask a boy for a simple sentence, he will probably tell you that "The man thrashed the horse," "The boy kicked the cat," or "The dog killed the rat." But this ought not to be encouraged. The statement is often hurled in our teeth that the existence of hooliganism is a reproach to the elementary schools of England. And, indeed, the indictment is not altogether baseless. We do not do half so much as we might to encourage the children to think on whatsoever things are lovely. We might do more in the reading lesson, in the composition lesson, even in the grammar lesson. Sternly reject all sanguinary sentences; place a high premium upon such as these—"The water of the fountain is splashing in the basin," "There are six roses on my rose tree," "The white clouds are sailing across the blue sky," "Rover has beautiful brown eyes."

NATURE STUDY FOR THE MONTH.

BY P. HORN.

THE present month is hardly the one which holiday-makers will select for a visit to the country. There are very few attractions, save for the sportsman or the ardent naturalist, who, warmly clad and heavily shod, manages to pursue his favourite hobby in spite of biting winds and sloppy fields. The prospect of finding anything of interest certainly seems remote, but the leafless trees and hedges will improve on closer acquaintance. By the roadsides, and in odd corners where the vegetation has been allowed to grow unchecked, a few tall seed stems still rear themselves above the surrounding growth, sole survivors of a departed autumn. The seeds have been scattered long ago, to lie unseen until the warm rains of spring cause them to germinate; but the blackened stems, tipped with dry, empty pods, still remain, rustling with every breath of wind. The yarrow, cow parsley, and thistle are conspicuous.

Small parties of goldfinches visit the thistle stems, so perhaps there are still a few seeds left. The goldfinches have a great liking for the seeds of noxious weeds, so they can safely be classed among the farmer's best friends.

Now is the time to study the different trees. It is astonishing how few people can distinguish an elm after the autumn frosts have brought the leaves down. Get some kind friend to indicate one; stand some hundred yards away, and take a good look at the skeleton tree as it stands out clearly against the pale sky beyond. The general outline, the trend of the boughs, and above all the pattern traced by the smaller branches, should convey an impression to the mind, and this impression in future should always be associated with the elm.

Of course elms are not all alike, but once the general

pattern has been grasped, these trees can be recognised even if they are lopped and distorted. The black poplar, with its open pattern and coarse twigs, looks decidedly draughty on a cold day. Perhaps this is the reason why it is not patronised by the birds, who much prefer to hold their winter meetings in a cosy elm. Each tree, too, has its own peculiar bark.

Town-dwellers can easily compare the plane with the lime, both trees flourishing in the grimy atmosphere of London.

The plane is particularly noticeable, owing to its smooth, mottled trunk, which annually sheds its bark in slabs. As these pieces peel off here and there, the new bark, being lighter in colour, gives the tree a piebald appearance. Now that the plane is leafless, the fruits are clearly visible. They resemble small balls, about the size of a cherry, strung on a string at intervals of a few inches.

That interesting plant the mistletoe has been very much in evidence lately, hanging from gas-brackets and other inconvenient places. In its natural state it hangs, as a parasite, on poplars and apple-trees. The method of propagation is curious. The berries, which ripen in the early spring, are much appreciated by certain birds, who, in their eagerness for their favourite food, unwittingly act as agents in distributing the seed. Take a berry, squeeze it, and notice how the fingers are soiled with a viscid, gummy juice. Suppose a bird drops a half-crushed berry on the bough of a tree. The seed, securely fastened by its gummy envelope, lies hidden in a crevice until the weather is favourable for germination. It now sends out a rootlet or sucker, which penetrates the bark, and strikes right into the solid wood, deriving nourishment from its passive host. The young plant increases in size, and becomes a fixture on its big neighbour. The writer calls to mind a mistletoe bough which has been growing for years from the arm of a black poplar. The obliging aspen seems none the worse for its generosity, and the mistletoe certainly seems to thrive. A cross section cut in the poplar would reveal the extent of the mistletoe's attachment.

Though the hedge berries are scarcer this season, a few words about them will not come amiss.

"Hips and haws" are the fruit of the wild rose and the hawthorn respectively. The "hip," which is the larger, is a brilliant scarlet fruit, containing a number of hairy seeds enveloped in a soft pulp. The "haw" is much smaller, and contains one seed.

In hard weather these hedge fruits form the staple food of the numerous members of the thrush tribe, who have a special liking for the sweet acid pulp, seldom leaving a bush until they have sampled every berry within reach. A few flattened red skins remain as evidences of the feast. The ill-timed frost which ruined the fruit crop last spring also destroyed a great deal of the birds' winter store in its early stages of development. Should we get a hard winter our friends will suffer.

One of the features of bird life at this time of the year is the gathering together of certain species in flocks.

In the case of the chaffinch, many of these companies are composed almost entirely of individuals of the same sex. I remember once, when procuring a specimen hen chaffinch, bringing down two other hens of the same species, together with a greenfinch—all of which birds happened to be in a line with the one aimed at. Curiously enough, the greenfinch was also a hen. We can understand the birds flocking in a favourable food area, but why the gentlemen should desert the ladies is a puzzling question. Bullfinches usually keep together in devoted couples; so perhaps the gay bachelor party of five who were picking about in a stubble field last week had copied the chaffinches' bad manners. These rosy-breasted gentlemen will not be quite so brotherly when spring returns.

The sparrow, as usual, is very much to the fore. When these rascals band together there is mischief brewing, as the unfortunate farmer soon realises. Descending in hundreds, they quickly get to work with their stout bills on the newly-sown corn. Now and again some restless individual, apparently troubled with a guilty conscience, causes the whole flock to rise like a black cloud, with a rumbling whir of wings. After wheeling round a few times they settle *en masse* and resume their depredations. To show the extent of the damage they do, four birds were procured from a large flock, and their crops were carefully examined. Results were as follows:—Four crops contained fifty-seven grains of barley and fourteen of wheat—an average of seventeen per bird. Quite three-quarters of the grain had been swallowed whole. The crop, I may as well point out, is simply an enlargement of the œsophagus or food-tube, at the base of the neck. It forms a pouch in which the grain undergoes a softening process, which doubtless aids its ultimate digestion. A large flock of rooks were assisting the sparrows in their depredations; but with their proverbial cunning, they adjourned to the tops of some high trees, and waited until the coast was clear again.

Both starlings and larks are now in flocks, but the members are, to a great extent, aliens who have left the plains of Northern Europe, to spend the winter with their cousins in England. To identify a foreign starling, examine the feathers covering the cheeks and the side of the head. If they show a purple gloss, the bird is Continental; if green, it is English bred.

This foreign invasion, which occurs regularly every winter, is called "migration," and the birds participating in it are "migrants." Several explanations have been put forward to account for this annual coming and going, the generally accepted idea being that the approaching winter cuts short the food supply, and forces the birds to migrate or starve. Whatever the real cause is, it is certainly wonderful that generation after generation should keep up old traditions, and brave the hardships of a sea journey.

Winter migrants may be divided into two classes—"partial," as the starling and the lark; and "pure," as the fieldfare and the redwing.

What constitutes the difference? Let us take examples.

Starlings, taken as a whole, are termed "partial migrants," because some individuals indulge in foreign travel, whilst the others stay at home all their lives. Coming to pure migrants, we have the fieldfare and the redwing, thrushes of Norway. There is no half and half or partial business about these birds. They all come over from Scandinavia in October (the redwings were actually passing over London one foggy Sunday evening last year), and make themselves at home with us during the winter. On the arrival of spring every individual bird returns to his native birch forests, and an English fieldfare in July would be as great a rarity as the dodo. I think this makes clear the terms "partial" and "pure" as applied to migrants.

The fieldfare is a handsome bird, with his rich yellow breast heavily speckled with black. As he flies off with his weird, laughing cry, the contrast between the pure white under the wing and the dark gray of the back renders him easy of identification.

The redwing might easily be mistaken for a common thrush, were it not that his flank feathers and under wing-coverts are a rusty red. He delights in the company of his fellows; but they appear to be a melancholy party as they sigh wearily to each other among the tree-tops. A hard frost causes them to forsake the iron-bound fields and repair to the hedges, where they feast on the berries in company with our thrushes and blackbirds.

A prolonged spell of frosty weather creates quite a stir in birdland.

When the sluggish river freezes, the beautiful kingfisher finds his finny prey secure from his attacks; so, like a sensible fellow, he makes his way up the smaller brooks, which seldom freeze, owing to the rapidity of the current. Here he levies toll on the minnows and sticklebacks, until a sporting farmer appears on the scene and sends him on a farther journey—this time to the local bird-stuffer, to be made into a suitable ornament for the best parlour.

The snipe with his long beak discovers that he cannot probe for worms in his favourite marsh, so he too follows the kingfisher's example, and shifts into the neighbourhood of springs and running water. If he also should be unfortunate, his plump little body ultimately reaches the cook, not the taxidermist.

Our little friends the redwings perish, not of cold (few birds die of cold), but of sheer starvation, caused by the locking in of the grubs and insects under the hard ground. If

the bodies are examined, the protruding ridge of the breast-bone will tell its own tale.

The robin, who is always pottering round the house with an eye to the crumbs, now has to share his titbits with other starving birds. Hunger and poverty are indeed great levellers.

Country folk can easily alleviate the sufferings of the birds, and at the same time derive considerable amusement for themselves, by putting out a plate of table scraps for their visitors, who will become quite tame. A piece of fat, or a cocoanut with the end sawn off, should be suspended from a bough for the benefit of the tits.

These clever little acrobats will soon become great favourites, since they are not at all particular as to what position they assume at table. Clinging to the underside of the nut with their feet pointing more or less skywards, they chip away merrily, to the great disgust of the uneducated birds, who, not being such expert gymnasts, have to remain on the ground, and be content with the scraps which occasionally fall.

The blackbird has his suspicions of the food plate, but the sight of the smaller birds busily engaged overcomes his discretion, and dashing in, he seizes a morsel and flies off to the nearest hedge to eat it.

Hard weather makes the smaller birds particular as to their choice of a roosting-place. Finches like evergreens and briar bushes, the blackbird prefers an ivy-grown tree, whilst the sparrows and tits ask for nothing better than a snug hole.

Contrary to the popular belief, birds do not "tuck their heads under their wings, poor things." They would probably contract a violent chill if they did. They prefer to keep their wings against the body, and lay the head on the *top* of the wing, along the groove between the humerus and the back. With his body feathers fluffed out, and the beak hidden amongst the scapularies, the bird looks like a headless ball of feathers.

How is it that a bird can go to sleep without tumbling off his perch? The weight of the body creates a pull on certain leg sinews which tend to draw the toes together into a fist, so that a bird grips the perch automatically by the mere force of gravity.

Old country houses attract numerous visitors, especially should the thatch be in a bad state of repair. It was my good fortune to be staying at such a place last Christmas. As evening drew in, numbers of restless birds (chiefly tits and sparrows) appeared in the orchard trees. Now and again a sparrow would fly up to the thatch, to be promptly ejected if the hole was already occupied. Three or four little jenny wrens had a common lodging just above the kitchen window, and before retiring to bed (about tea-time) they alighted on the window-sill, as if to see what crumbs would be available on the morrow. At eight o'clock, with the aid of a cycle lamp, I took a census of the thatch-dwellers.

The following birds were pulled out of their warm beds: sparrows (about a dozen), blue tits, and wrens. The latter, three in number, were all in the same hole. In previous years I have found the coletit and the tree sparrow, but this year they appearvd to be absent. The following evening all the birds reappeared as usual, as if nothing had happened; but as it was Christmas evening, they were not troubled again with horrible nightmares. In conclusion, I may say that these notes are the result of actual observation of the birds in a remote Buckinghamshire village.

Exhibition of Mechanical Engraving and Colour Printing.—The Board of Education, in co-operation with the Council of the Society of Arts, intend during the present year to hold, in the Victoria and Albert Museum, South Kensington, an Exhibition of Engravings produced by mechanical means, such as photogravure and other photographic processes, as a sequel to the Exhibition of Engraving and Etching held during last summer; and as great advancements have been made in printing in colours since the Exhibition of Modern Illustration in 1901, specimens of colour printing will be included. A committee, of which Sir William de W. Abney, K.C.B., F.R.S., will act as chairman, has been formed to advise the Board in carrying out the exhibition. All communications should be addressed to the Secretary, Exhibition of Mechanical Engraving, Board of Education, South Kensington.

A COMPLETE SCHOOL COURSE OF ELEMENTARY GEOMETRY.

"THE old order changeth, yielding place to new," is particularly applicable to the present state of geometrical teaching in this country. The past three years have been prolific in conferences, discussions, and suggested reforms; in the preparation of syllabuses and the publication of text-books designed to cover the courses outlined in these syllabuses. Almost every educational journal has had its articles on "Euclid Deposed," "Euclid's Rivals," "The New Geometry," etc., and the average teacher of geometry begins to wonder where he is. It ought to be possible at this stage to review the course of events, to discover the points of agreement among the various reformers, and to decide upon a satisfactory scheme which shall prove generally acceptable. This should be the more easily attainable, since the extremists on either side are neither numerous nor dangerous.

It is admitted that reform is necessary; and it is, therefore, essential to successful reformation to discover the causes of past failure in the teaching of geometry, in order that any amendment effected may remove such causes for the future. Undoubtedly the chief cause of failure has been the strict adherence to the text and sequence of deduction laid down in Euclid's *Elements*. Geometrical teaching has a twofold object—(*a*) to impart a certain amount of geometrical knowledge; (*b*) to provide logical training for the mind. In the *Elements* the former object is sacrificed to the latter, and owing to the cumbrous method adopted it most frequently happens that neither object is attained. The amount of geometrical knowledge contained in the first six books might be taught to an average student of twelve to fourteen years in eighteen months, while the disciplinary value is rarely evident in the case of students who have spent some years in the study of Euclid, owing probably to the faulty teaching, which has insisted strictly on the accurate reproduction of the words of the text, including definitions, axioms, postulates, and propositions. So much attention has been given to this verbal accuracy, that the geometrical truths embodied in the various propositions have not been assimilated, with the result that a student so taught may know his book-work perfectly, and yet be unable to apply his knowledge to the solution of a fairly easy exercise. How many teachers to-day look back with satisfaction on their first efforts in learning Euclid, or do not feel that a vast amount of time was uselessly squandered in such study? The main difficulty is linguistic, and not geometrical. A student is practically starting a new language when he begins the study of the *Elements*, and finding himself dealing with new terms and new ideas, with no preliminary training to assist him, no wonder he considers it difficult, gets bewildered, and acquires a thorough distaste for the whole subject. Having obtained by experience quite passable notions of what a point, a straight line, and a level surface are, he is turned on to the definitions, and his troubles begin. Is it natural that he should take to it kindly, or find any pleasure in it?

Of course, no one denies for a moment that a work that has held its own for so many generations, and has received the reverential homage of so many excellent teachers and scholars, must be of supreme value, and cannot be thoughtlessly superseded. No new system can possibly be evolved that is not influenced by, and somewhat dependent upon, such a standard work. There is no necessity for revolution. What is needed is an authoritative indication (with sufficiently wide limits) of a satisfactory course of school geometry. Is it possible to obtain this?

With respect to the teaching, there is a distinct advance, and the methods of thirty years ago are practically dead. Teaching as an art has made vast progress, and the improvement in the teaching of geometry owing to the reform movement is in the highest degree gratifying. There is no fear for the future, provided sufficient freedom is granted in the working out of any course, and examination bodies come into line with the new movement. This is, of course, a necessity. The retention of Euclid for so long a period has been due very largely to the requirements of the various

examining bodies. So long as success in teaching is tested by success in an examination, based on a certain syllabus, so long will it be necessary to work to that syllabus. But we are moving rapidly. The changes made in the preliminary examinations of Oxford, Cambridge, and London have done a great deal towards nationalising the teaching of geometry. The Board of Education examinations allow considerable freedom, and as far as one can judge by the present tendency, the next few years will see general uniformity in the requirements of examining bodies.

What should these requirements be? Bearing in mind the twofold object of geometrical teaching, and the breakdown of a system based rigidly on Euclid, it is generally admitted that induction as well as deduction should be evident in every course, that there should be an experimental and practical stage preliminary to, and continuous with, the purely demonstrative stage. The experimental work might be done in the kindergarten, and consist of easy exercises in building up various geometric forms from their elements, and learning the names and more obvious properties of the figures so constructed. The practical stage may be regarded as that requiring the use of instruments leading to exact measurements of lines, angles, etc., and exact constructions of various lines, angles, and figures fulfilling given conditions. Much of this would precede the formal study, the remainder of the course serving as illustration and verification of the geometrical truths formally demonstrated. Before giving a detailed outline of such a course, one or two important points must be insisted upon. This practical work, to have any real value, must be carefully graded, and accurate. It is quite easy for length measurements to be exact to the nearest millimetre, and angles to the nearest degree. The time when two triangles (obviously unequal) were carelessly drawn to illustrate I. 4, and proved equal in all respects, has gone. A permanent record of all the work should be retained in a suitable notebook, which should also contain all the necessary explanations and definitions of terms required from time to time. When a practical construction is made to verify some formally demonstrated truth, it is necessary to distinguish such verification from a proof. All looseness in this respect must be guarded against, particularly in young students, otherwise the second object in geometric teaching is endangered.

The instruments required for a practical course are a ruler graduated in millimetres and in inches and tenths, a protractor (a transparent celluloid one is very convenient), compasses and dividers, two set squares (45° and 60°), and hard pencils. In addition, for work dealing with areas, squared paper is desirable. Supposing a student properly equipped, the following outline indicates a course of practical work preliminary to any demonstrative course. Further help may be obtained from *Practical Exercises in Geometry*, by W. D. Eggar.

1. *Measurement of Length.*—Given straight lines to be measured in inches and tenths, and centimetres and millimetres; measurement of length and breadth of a page of notebook; measurement of length and breadth of desk; measurement of lengths of parts of given divided line to be added, and checked by measuring whole line; construction of lines containing a given number of inches; measurement of number of centimetres in such lines; judging at sight various lengths, and verifying by measuring; use of compass in construction of circle, and explanation of terms circumference, radius, diameter, chord; measurement of diameter, radius, and chords in given circles; construction of circles of given radii and measurement (by means of string or in any other way) of circumference; measurement of diameters and circumferences of various coins.

2. *Angular Measurement.*—An angle to be regarded as the difference in direction of two straight lines, and to be measured by the amount of turning necessary to get from one direction to the other; explanation of right angle, derived from above conception; distinction between turning in one direction and turning in opposite direction (positive and negative directions); explanation of degree, and graduation of protractor; use of protractor in measuring given angles; calculation of angle between hands of a clock at different times; measurement of angles of set squares; calculation of angles between various points of the compass; construction of angles by means of protractor; explanation of terms obtuse and acute; measurement of the two angles made on one side of any straight line by another meeting it; measurement of the angles formed when two straight lines intersect; measurement of the three angles in any given triangle.

The above outline will be completed next month, following which will appear a course of theoretical geometry, not involving Euclid's sequence, indicating alternative proofs, and covering the ground of the first six books in accordance with the latest wishes of the modern reformers.

PRACTICAL HELP IN THE ARITHMETIC LESSON.

BY GEORGE COLLAR, B.A., B.SC.,
Joint Author of "A New Arithmetic."

THE "rule" that we propose to deal with this month is Multiplication. This is best taught by regarding it as the addition of equal quantities. Proceeding on these lines, the multiplication tables can be built up before they are memorised:—

1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
3	6	9	12	15	18

etc. This calls the intelligence into play, and when there has been a fair amount of repetition of the tables, any question on the tables will be sufficient to suggest the answer. When a child is asked, "What are six nines?" he never attempts to visualise or form a mental picture of nine objects, still less does he attempt to visualise six such groups; but he gives the answer "Fifty-four" at once, from force of habit.

If addition has been taught properly, there is no difficulty in teaching multiplication by numbers not exceeding 12. The next step is to multiply by 10 and powers of 10, showing the fact that the significant digits remain the same, but have different positions, the change of position being shown by placing one or more noughts to the right. It is of the highest importance to press upon the children that the change of value is due to the *change of position;* the affixing of the noughts is merely a method of indicating the change of position without altering the value of the number in any other way. In the number 463 each digit is made ten times as valuable by moving it one place to the left, whether we write 0, or 7, or any other digit on the right. The difference is that if we write 4,637, we multiply the number by 10, *and add on 7 at the same time*; but if we write 4,630, we multiply by 10, and do nothing more. It would be well here to introduce the decimal notation to the children's notice, and explain that if a dot is placed after a digit in a number that digit is the units digit, no matter how many digits follow the dot. Hence 46·37 is not multiplied by 10 by affixing 0, because that leaves the digits in their original position; it must be effected by moving the dot—that is, by altering the position of every digit. This presents no difficulty, and prepares the way for decimals, while it makes the teaching of simple multiplication so much more thorough.

The third step consists in multiplying by multiples of 10, 100, etc., and the principle should be illustrated by multiplying small numbers together. Thus, 4 times 3 times 5 is (4 times 3) times 5, or 12 times 5, as can be proved by referring to the tables; so 10 times 6 times 463 is (10 times 6) times 643, or 60 times 463. Hence children can be made to understand the rule that they multiply 463 by 6, and multiply this result by 10 by writing each digit one place further to the left.

The last step consists in showing that if a quantity be multiplied by two numbers and the results be added, the total will be the same as that obtained by multiplying the quantity by the sum of the numbers. Numerous illustra-

tions should be given with small numbers that can be checked by the tables—for example, $7 \times 4 + 7 \times 2 = 7 \times 6$, $9 \times 5 + 9 \times 6 = 9 \times 11$. So, if we have a number of purses, each containing twenty-three sovereigns, the total number of sovereigns in, say, sixty-eight such purses will be the same as the number in sixty plus the number in eight of them. This may seem self-evident, but it must be insisted upon in order that children may use partial products with intelligence, and not work by rule of thumb.

The higher classes of the school should, from time to time, have a lesson on simple multiplication, for the sake of keeping them in mind of the fundamental principles on which it is based, and also for the sake of introducing shortened methods, which should be demanded in the upper classes, but which are not suited for very young children.

No one, except a very young child, should be permitted to go through the needless operation of multiplying by 1 and writing down the result. In order to show the method of avoiding this, the teacher should multiply some numbers by 11, using the method of partial products. At first, numbers should be chosen in which the sum of two adjacent digits never exceeds 10. In such examples as the following, the children will see that there is nothing to be gained by writing down the two partial products, for they have the digits written in the top line. The only work required consists in adding these two partial products together, which may be done by setting down the right-hand digit of the multiplicand, and then the sum of each digit and its left-hand neighbour; the last digit, having no left-hand neighbour, is written down by itself.

2,536	4,837
11	11
2,536	4,837
2,536	4,837
27,896	53,207

After several examples of this type have been worked, others may be given in which carrying figures occur. This paves the way for multiplication in one line by such numbers as 18 and 81.

5,827	5,827
18	81
46,616	5,827
5,827	46,616
104,886	471,987

The method is soon explained by reference to an example worked in full on the blackboard. It will be seen that the correct result can be written down at once by merely multiplying each digit by 8 and adding the digit to the right or left of the one multiplied, according as the 1 stands to the left or right of the 8. If it stands to the right, we must begin by setting down the right-hand digit of the multiplicand; and if it stands to the left, we must finish by setting down the left-hand digit, either alone or increased by he number carried from the last step.

The same plan should be adopted whenever 1 appears in a multiplier; thus, in multiplying by 215 the second partial product will be obtained in the same way as the product of the multiplicand by 21, but it will, of course, be set one place to the left.

Very often one partial product may be more easily obtained from another than by direct treatment of the multiplicand. In multiplying by 84, for instance, after multiplying by 4 it is easier to multiply this result by 2 than to multiply the original number by 8. There is a special advantage to be derived from this method when using such multipliers as 497, in which only two partial products are necessary instead of three; for when we have multiplied the number by 7, we can find 490 times the number by multiplying this result by 7 and setting the first digit in the tens place, instead of multiplying the number itself by 9 and then by 4.

The question is often asked whether we should begin by multiplying by the left-hand digit or the right-hand digit. The usual practice is to begin with the right, but there seems to be no advantage in so doing. On the other hand, those in favour of the opposite practice urge (*a*) that there is a distinct advantage in multiplying by the highest order of digits first when we come to work approximate calculations in decimals; (*b*) it is the method employed in calculating approximate roots of equations; and (*c*) it is but taking the digits in their natural order. We should, I think, admit the force of these arguments, and make a general practice of multiplying by the highest order first; but the fact should be pressed home that as far as the actual example is concerned the order is immaterial, and that sometimes the working may be abbreviated by beginning with the units digit.

There is a strong tendency to forget the place value of the digits used in working multiplication sums, and teachers should make a practice in every lesson of calling upon the class to read correctly some of the partial products, or to state exactly the value represented by any given digit in the working or result.

PROBLEMS.—A person spends $\frac{4}{9}$ of his income in board and lodging, $\frac{1}{8}$ in clothes and other expenses, and saves £84; what is his annual income?

Let the children reason out such a problem by analysing the income in two ways.

Since $\frac{4}{9} + \frac{1}{8} = \frac{8+3}{18} = \frac{11}{18}$, there are $(1 - \frac{11}{18})$ of the income not spent, but saved. But the question tells us that the amount saved is £84.

$\therefore \frac{7}{18}$ of the income = £84.

$\therefore$ the income = £84 $\times \frac{18}{7}$ = £216.

This will not present much difficulty, but children are apt to say $\frac{7}{18}$ = £84. This is incorrect, for the fraction $\frac{7}{18}$ is a purely abstract number, and cannot equal a sum of money.

The pupils should now be set to construct such problems by stating that such and such fractions of a sum of money were spent and so much money was left, and then asking what was the original sum. If left to themselves, they will probably select fractions whose sum is not a proper fraction—for example, $\frac{1}{2}$ and $\frac{3}{4}$; and it is better to let them find out for themselves the necessity for the restriction. In helping them to discover their error, it is better to lead them on step by step; for a child does not see the impossibility of spending $1\frac{1}{4}$ times an amount of money out of the sum itself so readily as he sees that when a half has been spent there will be a half left, and that he cannot spend three-quarters out of a half. However, that is a minor point, and it is best to present both views.

The teacher can work some of the pupils' examples on the blackboard, and collect the best for future use.

The following are problems of this type:—

1. I started with a sum of money and spent $\frac{1}{3}$ of it, then $\frac{1}{4}$ of it, and had 10d. left; how much had I at first?

2. I walked a certain distance along a road, and then returned; and when I had done $\frac{3}{5}$ of the journey home, I found I had a mile and a half further to walk. What was the total length of the double journey?

3. A man sold $\frac{2}{7}$ of his estate to one person, $\frac{3}{5}$ to another, and $\frac{1}{4}$ to another, and found that he had 45 acres left. Of what did his estate consist?

4. One-third of a collection of money was in gold, seven-fifteenths in silver, and there was £1, 10s. in bronze; what was the value of the whole collection?

One or more of the fractions given may be a compound fraction, and this will require simplifying in the working; and, moreover, care must be exercised to ensure that the pupil does not find *half of the first part* when the question says "half of the remainder."

5. A person spends $\frac{1}{3}$ of his money, and then $\frac{2}{5}$ of what he has left, and finds he has half a crown left; how much had he at first?

6. A man loses five-sixths of his capital, and then loses seven-ninths of the remainder; if he has £30 left, what was his original capital?

It should be observed that if the sum a person spends is a proper fraction of what he has left, he will always have some in hand.

It may be worth while, when children propose questions involving the spending of more than the whole, to let them take a few of the following type:—

7. Two women went shopping, and one bought articles worth respectively $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ of the money she had with her, and was obliged to borrow 7½d. from her friend. How much had she with her?

Among problems generally worked by fractions we may deal with questions on taps, united work, etc. These are frequently set, and there is really no need at all to employ fractions, and it is much better to work by means of the least common multiple. For instance: If one man can mow a certain piece of grass in 6 hours, and another can do it in 9 hours, how long would they take to do it working together?

Here the usual method is to find what fraction each man can do in one hour; add these together, and divide one hour by their sum. But it is much simpler to consider the amount of work that could be done in 18 hours—that is, the L.C.M. of 6 hours and 9 hours. One man could do three such pieces of work, and the other could do two; so that they could do five such pieces in 18 hours if they worked together, and therefore would take $\frac{18}{5}$ hours to do the one. To an adult who is accustomed to deal with fractions this method may seem to offer no advantages; but it is a fact that children are able to visualise whole numbers and form clearer conceptions of their working in this way than by means of fractions.

8. Two taps can fill a cistern in 3 hours and 4 hours respectively; in what time could they fill it together?

9. Two taps can fill a tank in 12 hours and 15 hours respectively; in what time could they fill it together?

10. A boy takes 4 hours to do a piece of work that a man can do in 2½ hours. How long will they be doing it if they work together?

11. Three men's wages are at the rate of 25s., 30s., and 35s. a week. How long will they serve together for £6?

12 A earns £1 in 3 days, B in 4 days, and C in five days. If all work together, in how long will their united wages amount to £60?

13. Two men, A and B, working alone, can finish a piece of work in 8 and 9 hours respectively. If they work for one hour each alternately, and A begins, in how many hours will the work be finished?

14. Three persons, A, B, and C, could complete a piece of work in 9, 10, and 12 hours respectively if they had worked separately. They work together for 45 hours; how many such pieces could they complete in that time?

In this connection we must deal with cases in which one result counteracts the others, as in the case of a bath or a cistern, which has both inlets and outlets. Here, again, we work by the L.C.M. of the several times, and find the net result in that period.

15. Two taps can fill a cistern in 2½ and 4 hours respectively, and another tap can empty it in 3 hours; in what time would the cistern be filled if all were opened together?

Here we might remark that instead of taking the L.C.M. of 2½, 4, and 3, we can take that of 5, 4, and 3, since the cistern can be filled an exact number of times in 5 (or a multiple of 5) times if it can be filled in 2½. The L.C.M. of 5, 4, and 3 is 60. Therefore in 60 hours the first tap could fill 24 cisterns, the second 15, while the last could empty 20. This gives a net result of 19 cisternfuls in 60 hours. Therefore the combination would fill one cistern in 60 hours ÷ 19 —that is, $3\frac{3}{19}$ hours.

16. Two taps can fill a cistern in 6 and 8 hours respectively; a leak would empty it in 20 hours. In what time would the cistern fill if all run together?

17. A bath could be filled by the hot-water tap in 30 minutes, and by the cold-water tap in 20 minutes. These were both turned on together; but the bath took a quarter of an hour to fill, because the waste pipe was open. In what time would the waste pipe empty the bath if it were filled and the two taps turned off?

18. A and B together do a certain piece of work in 15 days which A alone could have done in 25 days; how long would the work have taken B alone?

19. A and B together can do a certain work in 12 days, A alone can do it in 20, and C alone can do it in 25; how long would it take B and C together?

20. The waste pipe of a bath can empty it in 12 minutes if the tap is not running, but it takes 20 minutes if the tap is running. In what time would the tap fill the bath if it is emptied and the waste pipe closed?

21. A can do a piece of work in 15 days, B in 20, and C in 25. A and B begin it together, and when they have done half the work C joins them. In how long after this will the work be finished, and how long have A and B been working before C joins them?

22. A man can do in 12 days a piece of work which a boy can do in 20. How long will it take a man and 2 boys to do the work?

23. A man can do in 30 days a piece of work which a boy can do in 40. How long will 3 men and 4 boys take to do the work?

OUR ILLUSTRATED GEOGRAPHICAL NOTEBOOK.

THE STRAITS SETTLEMENTS.

THE Straits Settlements are Penang, Wellesley Province, Malacca, and Singapore, but practically all the southern portion of the Malay Peninsula is under British protection.

Penang, or Prince of Wales Island, lies at the head of the Strait of Malacca, two to ten miles from the west coast of the Peninsula, and 360 miles from Singapore. Its area is about 110 square miles. It was ceded to Britain by the native rajah in 1785, in consideration of a pension of £1,000 per annum. Georgetown is the capital.

Wellesley Province, with an area of 270 square miles, is a portion of the mainland opposite Penang, of which settlement it forms a part.

Malacca is the largest of the Straits Settlements. It consists of a strip of territory between Penang and Singapore, having a length of about 42 miles, with a breadth varying from 8 to 24 miles.

Singapore is an island with an area of 206 square miles, separated from the southern extremity of the Peninsula by a strait little more than half a mile wide. The sultan of Johore sold the island to Britain in 1824 for £12,000 and a life-rental of £5,000.

People.—In 1901 the population consisted of 215,000 Malays; 282,000 Chinese; 57,000 Hindus; 15,000 Eurasians; 10,000 Europeans. The influx of Chinese is rapidly increasing. In 1899 about 150,000 Celestials landed in the settlements; in 1900 the number was 200,000. In the same years the Indian immigrants numbered 18,000 and 35,000 respectively.

The Malay character is very complex. The people are generally undemonstrative and taciturn, and exceedingly chary of offending one another; humour enters but little into their lives. Theft, poisoning, falsity, and treachery are common. Thanks to British administration, these characteristics are becoming less marked; and although careless of human life, mere baby boys are no longer seen with ferocious-looking knives stuck in their belts, nor are peace-loving Chinamen shot at sight on the merest provocation. Many Malays are employed in the British mercantile marine, and affrays among them are frequent. Sometimes an infuriated native will run *amok*, first taking vengeance on his opponent and then wildly attacking every person within reach.

Climate and Productions.—The climate of the Peninsula is moist and hot, and malaria prevails along the low banks of the streams. Yet, owing to the elevation of the land and the prevailing breezes, the mean temperature is lower than in many parts of Asia farther north of the Equator. The climate of the British settlements on the coast is that of perpetual summer, ranging from 79° to 84° all the year round.

Everywhere the land is clothed with dense tropical vegetation; the chief trees include gutta-percha, ebony, bam-

boo, camphor, different varieties of palm, rubber plants, rattans, etc.

The wild animals include the elephant, tiger, rhinoceros, monkey, hog, etc. The birds are marked by brilliant plumage—bird of paradise, humming-bird, pheasant, etc. Notwithstanding the spread of roads passable for vehicles, the elephant is still of great importance for transport purposes. Formerly this animal was practically the only means of land conveyance in a country largely covered by jungle. The elephant is even now employed in conveying rice to the mines of the interior, returning laden with pigs of tin. The more important chiefs keep studs of elephants as a mark of high dignity.

The minerals include gold, silver, iron, and coal, and the Peninsula is the richest tin-yielding region in the world.

Industries.—Mining operations are largely confined to tin, but the richest fields are in the federated states. The price of the metal during a comparatively recent period has risen from £60 to £120 per ton, and has caused tin-mining to attract increased attention. The tin-miners are chiefly Chinese, who have already made vast inroads upon the forests to supply the fuel for smelting the ores. Much of the metal is obtained by hydraulic sluicing of the hillsides.

Agriculture provides a large field for profitable activity. The chief objects of cultivation are rice, sugar-cane, cotton, tobacco, coffee, cocoa-nuts, tapioca, sago, pepper, gambier, spices, etc. Agricultural labour is provided largely by the Indian immigrants, who enter the settlements under the strictest government supervision. They are indentured for a term of years, and at the end of their service return to their native land if they desire it.

Rubber.—The Malay Peninsula is the home of several plants that yield rubber and gutta-percha. The natives, however, felled the trees in order to extract the commodity, and thus incurred a danger of cutting off a source of considerable wealth. Now the government plants trees, and extracts the rubber from the leaves and twigs without injury to the trees. Para rubber has been introduced with such great success that increased areas are rapidly being brought under cultivation.

Tapioca is a species of starch derived from the roots of the cassava plant. The roots are peeled, and when enclosed in bags made of rushes are put in water under great pressure. The juice which is pressed out is a deadly poison, but the farinaceous matter which remains is wholesome and nutritious.

Sago is extracted from the pith of the sago palm. After the starch has been washed from the pitch it is dried for use. Granulation is obtained by making the starchy meal into a paste and forcing it through a sieve.

Gambier is extracted from the leaves of the *Uncaria gambir*. A gambir plantation resembles brushwood of several years' growth. The leaves are collected three or four times a year. Boiled in a cauldron, they yield a strong decoction which hardens as it cools, when it is cut up into 1½-inch cubes, resembling little blocks of yellow mud. Gambier is used in medicine as an astringent; it is of value in tanning; and is useful in housebuilding and shipbuilding, to preserve wood from ants and dry rot.

Rattans are canes yielded by a plant which is a genus of the palm family. In girth they range from a goose-quill to a stout walking-stick. They are used in the manufacture of mats and basket-work. Apparently insignificant, they are exported in such vast quantities as to form a very considerable item in the trade of the regions which produce them.

Commerce.—The chief imports into the Straits ports are cotton goods, opium, tea, coffee, gambier, rice, tobacco, hardware, copra, pepper, gums, rattans, sago, tapioca, tin, and coal; most of these, however, are re-exported.

The chief exports to the United Kingdom are tin, spices, gambier, gutta-percha, rubber, sago, and tinned fruits, especially pineapple. Total annual value, £7,000,000.

The principal imports from the United Kingdom are cottons, iron, machinery, etc. Annual value, £3,000,000. The total value of all the imports and exports is not less than £60,000,000.

Singapore.

Singapore is the principal town of the Malay Peninsula, and one of the most important ports of the British Empire. It is a great mart for the collection of the varied products of the East, and a distributing centre for the manufactured goods of the United Kingdom. From its harbour radiate shipping routes like the strands of a gigantic web, and at its wharves may be found vessels belonging to the merchant navies of all the great trading nations of the world. The port is strongly fortified, and is one of the most important coaling stations on our great sea routes. The streets of the city present a scene of bustle and activity, and there is a general air of prosperity on every side. The population is most cosmopolitan, but the lower classes of the different races generally occupy separate portions of the town. The Chinese, however, are everywhere, for the shopkeeping and most of the local trading are principally carried on by them. They are usually law-abiding, but sometimes the lower classes resent new regulations, and indulge in rioting. The better class of Chinese who have a stake in the colony do not indulge in these outbreaks, for there is a law that provides for the deportation of persons dangerous to the peace of the community.

So important are the Chinese that even much of the banking business is controlled by them. The collection of the spirit and opium duties is also let to syndicates of Chinamen, and as half the revenue of the colony comes from these two duties, the importance of the concession may be realised.

Nowhere else in the world has John Chinaman secured the esteem of Western nations as in Singapore.

The Federated States.

The federated states of Perak, Selangor, Negri, Sembilan, and Pahang have an area of about 27,000 square miles; population about three-quarters of a million, of whom over

300,000 are Chinese. Each state possesses a council, consisting of the highest native authorities, together with the principal British officials. About 1,500 miles of cart road have been constructed, and there are 300 miles of railways connecting the principal mining centres with the sea or river ports.

To Sir Frank Swettenham belongs the credit of bringing about the federation of the states. At the capital of the sultan of Perak was held a magnificent durbar to celebrate the event. One of the most noticeable figures at the banquet was the aged sultan of Pahang, whom the British resident-governor described as "a man of charming manners notwithstanding a record of ninety-nine murders committed with his own hand."

These regions are yet hardly properly explored, immense fields for development remaining to be opened up; and there is every probability of future prosperity.

SOVEREIGN OF THE SEAS.

Britain's sovereignty of the seas is divided into eleven sections. From Gibraltar to the North Cape the Channel Fleet cruises to and fro, round and about our coasts. The new naval base in the Firth of Forth will lead to the division of this work by the formation of a squadron for the east coast. Next in importance comes the Mediterranean Fleet, which is composed of our most powerful vessels, and is the core of our naval system.

At the Red Sea the beat of the East Indian Squadron begins, and runs to Singapore, where the China Fleet takes charge of British interests. The Pacific Squadron joins hands and patrols to the west coast of America, while a sixth squadron is allotted to Australia. From Cape Horn to the Gulf of Mexico is in the custody of the South American Fleet, and thence up to Newfoundland and beyond the North American Fleet holds sway.

Capetown is the base of the squadron which patrols the East African coast, and the other side of the Dark Continent is watched by the West African Squadron, which connects with the Channel and Mediterranean Fleets at Gibraltar. Thus British warships girdle the entire globe, and the belt is so elastic that it can be strengthened at any point where need arises.

TUMUT—AUSTRALIA'S NEW CAPITAL.

In the south-eastern corner of the vast colony of Australia, hidden away among the foothills of the great Muniong range, lies a small township that will soon have to change its name. There are only fourteen hundred people in and about it now (though it has a mayor and council of its own, for all that—municipalities begin young in Australia); but in a few years there will be as many thousands, and perhaps tens of thousands. The spreading, scattered little houses will still bask placidly enough among their trees on the long, slow slope to Tumut River; but on the other slope, that is now just sheep-paddocks covered with the wiry native grasses and dead timber standing ghostly white, there will be great palaces of granite and marble—Government House and Parliament House, with public offices and private mansions—such as become the dignity of the Commonwealth's chief city.

The surroundings of Tumut are prosaic enough—most of the houses are two-story brick, one-story weatherboard, but all of them roofed with galvanised iron—yet they manage to epitomise Australia fairly well. If you go there by rail, branching off at Cootamundra from the main Sydney to Melbourne line, you will for a year or so yet leave the train at Gundagai, on the old coach-road where the bushrangers used to ply their trade. Butcher Morgan terrorised all this district forty years ago, and Captain Moonlight was brought prisoner into the little town as late as 1879. There was an older Gundagai, too, than the one you see nowadays. The first settlers had camped on the great Murrumbidgee flat; but in 1852, when the river Tumut came down in full fury, filling the broad valley from ridge to ridge, old Gundagai was swept into annihilation.

Now the road and the new railway cross on a bridge which is well above flood-mark, and run, by the river and up the Adelong Creek, through one of the oldest goldfields in the colony. Hereabouts is the first mine in which payable gold was struck. The mine is a thousand feet deep, and a government reward of £1,000 was paid for sinking it. Most of the work is now done by sluicing, and more than a thousand loads a day are washed in the district. As soon as the traveller passes the low divide beyond Adelong and drops into the Tumut valley itself, a warm, fertile country opens before him—almost the first spot in New South Wales that found the value of irrigation. Tobacco will grow there, and maize, and fruits of all sorts; while between the river-flat and the great ridges to southward there are climates to suit all tastes. According to the official report, "failure of crops in the district has never been known."

DURATION OF THE WORLD'S COALFIELDS.

A few years ago there was published, by the celebrated Breslau geologist Professor Dr. Frech, a most interesting work, treating with great thoroughness the question, "When will our coalfields be exhausted?" According to Dr. Frech's calculations, Germany is the richest country in Europe in future stores of coal, and is only superseded in this respect by North America and North China. The present production of coal in England is actually higher than that of Germany, but this denotes a more rapid exhaustion of coal stores.

The following table shows the probable time of exhaustion of the principal European coalfields:—

Duration of 100 to 200 years—the coalfields of Durham and Northumberland, Central Bohemia, Kingdom of Saxony, and the province of Saxony (coal all but exhausted). The thinnest layers of coal and the smallest number of seams are to be found in the coalfields of Central France.

Duration of 200 to 250 years—all other British coalfields.

200 to 300 years—Waldenburg Schatzlarer district.

300 to 400 years—Northern France.

600 to 800 years—Saarbrücken district, Belgium, Aix-la-Chapelle, and the contiguous Westphalian district, including the Ruhr.

1,000 years and upwards.—The greatest number and the thickest coal seams (about 5,000 mètres) are found in the coalfields of Upper Silesia; its eastern prolongation, Russian Poland; and its southern prolongation, Moravia.

After a thousand years, when the European and North American coalfields are exhausted, it is possible that the coal and ironstone of Shansi, in Northern China, may make that district a centre of the world's industry.

RUSSIA AND BRITAIN ON THE AFGHAN FRONTIER.

The southern frontier of the vast empire of western Asiatic Russia marches with Turkey (in Asia), Persia, and Afghanistan. Between this and the area under the British flag lies the "buffer" state of Afghanistan, which, in the neighbourhood of the Pamir Plateau, narrows to a strip of land between the Hindu Kush range and the Oxus River. The Russian and British railway systems are both carried up to the Afghan frontier, about four hundred and thirty-eight miles separating the two frontier stations of Kushk and Chaman. To bridge this distance by railway would cost about £3,000,000. Kushk is at the end of the new military railway from Merv, and is strongly and heavily armed. A large reserve of railway material is stored here, which in certain eventualities might be used as a rapid means of advance to the famous town of Herat, which is about seventy miles distant.

The frontier of Afghanistan at Kushk was demarcated by British and Russian Commissioners, and a violation of this frontier would therefore be resented by Britain.

Chaman is the most advanced railway station in the western frontier of our Indian Empire; and a reserve of railway material is also stored here, which could be used for laying down a railway to Kandahar, which is about eighty miles distant. The Afghan frontier at this place is laid down according to the Durand Agreement between Great Britain and the late Ameer of Afghanistan. The Ameer is our ally, and receives a subsidy from the Indian Govern-

ment of 180,000 rupees a year. If Britain violated this frontier, or if there were internal troubles among the Afghan tribes, Russia would have no right to interfere.

The Transcaspian railways are not yet connected with the European railway system of Russia, and the military posts in this region are at present fed from the Caucasus. A line, however, has been projected from Alexandrof-Gai, near Saratof, *vid* Kungrad and Amu Daria to Charjui, which will bring Kushk within a week of Moscow. The Russians have further commenced operations with the construction of a railway which will connect their Transcaspian line with the Persian province of Khorasan. This line will start from Askabad, and be carried to Meshed, which is only a short distance from the Perso-Afghan border. With this object, the Russian Bank has opened a branch in Meshed to assist in the financing of the works.

KINDERGARTEN GAME.

THE KING'S REVIEW.

BY SISSIE TURLEY.

King.

To-day the queen and I
Are holding a review;
Now, soldiers, you must try
To prove my words are true;
For I have told the queen
That in this London town
She never will have seen
Brave men of such renown.

Refrain (All).

We belong to dear old England,
Proudly let us sing;
We will live and work for England,
For her queen and king.

Soldiers.

As soldiers brave we try
To guard our English home;
"Long live the king," we cry,
Wherever we may roam.
For sometimes we are sent
To countries far from here,
But do not then repent
We serve our country dear.

Refrain (All).

We belong to dear old England,
Proudly let us sing;
We will live and work for England,
For her queen and king.

Nurses.

We nurses now are here
To greet the queen and king;
We help the sick, and cheer
Sad hearts, and comfort bring.
In war time, far away,
Our soldiers hardships bear;
So while you reign we pray
That peace we all may share.

Refrain (All).

We belong to dear old England,
Proudly let us sing;
We will live and work for England,
For her queen and king.

Sailors.

The sailors now appear,
True English lads and strong;
Although we laugh at fear,
We fear to do the wrong.
Our sailor suit is blue,
With flannel round our necks;
We roll a little too,
As though we walked the decks.

Refrain (All).

We belong to dear old England,
Proudly let us sing;
We will live and work for England,
For her queen and king.

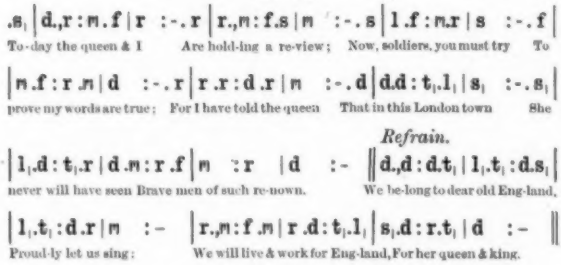
Children.

We children come as well
The great review to see;
And when we heard the bell,
We rose so cheerfully.
We left our books and sums,
We marched to see the king;
And now, with fife and drums,
We help the soldiers sing.

Refrain (All).

We belong to dear old England,
Proudly let us sing;
We will live and work for England,
For her queen and king.

Music.


To-day the queen & I
Are hold-ing a re-view;
Now, soldiers, you must try
To
prove my words are true;
For I have told the queen
That in this London town
She
never will have seen Brave men of such re-nown.
We be-long to dear old Eng-land,
Proud-ly let us sing:
We will live & work for Eng-land, For her queen & king.
Refrain.

Instructions for Game.

The class stands at the back of the hall. First the king and queen are chosen. They advance to arm-chairs, and take their seats on the throne. (Gold paper crowns are easily made, and long cloaks can be used to serve for regal robes.)

The *king* sings (standing) his verse; then all the class sing the refrain.

Now half the number of *boys* march forward with martial tread, and form a long line before sovereigns, halt, salute, then sing their verse. All join again in refrain.

The *nurses* now line up in front of soldiers, bow, and one nurse presents a bouquet to the queen. She steps forward, and bestows medals on a few.

The *navy* now start forward with swinging gait, and after verse and chorus march behind soldiers.

The smallest in the class now march before the rulers, and form a line before the nurses.

The band now play their imaginary instruments to help the last chorus.

The best conducted subject may be chosen for the next king and queen.

BELGIAN TEACHERS' CONFERENCE.—We have been asked to insert the following preliminary notice:—

On the occasion of the Liége Exhibition in 1905, an international congress on elementary education will be organised in that town, under the direction of the Fédération Générale des Instituteurs Belges. All foreign associations of teachers, as well as the principal educationists of Belgium and other countries, will be invited. For further information apply to Monsieur P. Cnudde, General Secretary of the Education Committee of the Congress, schoolmaster at Lyngem (Belgium).

DIFFICULTIES OF FRENCH IDIOMS AND CONSTRUCTIONS.

V.

Sire is not "sir," but is used in addressing sovereigns. It is also used in the phrase *un pauvre sire*, meaning "a poor man."

Sol means the "soil" or "ground." While exactly in spelling like the Latin word for "sun," it is derived from the word *solum;* whereas *soleil*, meaning "sun," is derived from the popular Latin diminutive *soliculum*.

Son is a word whose translation might give rise to difficulties. In addition to being the pronominal adjective "his," "her," it is a noun meaning "sound." As a substantive in this signification it easily suggests the English word "sound," as both words are derived from the Latin *sonus*. But it has another use. *Son* means the "bran" which results from the grinding of corn. The derivation of this word is somewhat uncertain.

Supplice is a word whose meaning is easily apparent to the Latin scholar, as it comes from the Latin *supplicium*, "punishment." "*La vue de son propre cœur devient son supplice*," says Fénélon. It might, however, suggest to an English reader the translation "supplication." This latter word has the same spelling in French as in English.

Talon at first sight suggests the word of like spelling in English. It means, however, "heel." Hence the familiar expression, *montrer les talons*, means what we express by talking of "showing a clean pair of heels." The English "talon" is expressed in French by *griffe*. "*On connaît le diable à ses griffes*," says a familiar proverb.

Terme is a French word which easily lends itself to wrong translation. It bears several significations in each language. In English and in French it may mean the manner of expressing an idea. Pascal says, "*Je n'ai point de termes pour qualifier une si extravagante créature.*" Also in logic we may talk of *les trois termes du syllogisme*, and in algebra of *les termes d'une équation*. In French, *terme* may mean the time at which rent is due. The English "term," as used in the sentence, "What are your terms?" would be in French, *Quels sont vos prix* (or *vos conditions*)?

Tuteur would suggest the English word "tutor," but it means the "guardian" of a minor, etc. Thus Fénélon says, "*Les souverains ne sont que les pères et les tuteurs du peuple.*" "Tutor" would be *précepteur* or *maître*.

Vaisselle and *vaisseau* are liable to cause confusion in the mind of the beginner. The latter word means a "vessel" in its various English significations of a receptacle for liquids, a vessel which floats on water, and in its anatomical sense. *Vaisselle* means the entire collection of plates, etc., used for the table. Thus, *laver la vaisselle* is to "wash up" after meals. In more modern times the use of the word has been extended to gold and silver plate.

Vers as a substantive may be the plural of *ver* ("worm"), or it may mean a *line* (not a *verse*) of poetry. A "verse" of poetry is *une stance* or *une strophe*. Boileau says that, as a result of the teaching of Malherbe, *les stances avec grâce apprirent à tomber*. A verse of the Bible is, however, *un verset*.

Vicaire, as we have already mentioned, is not "vicar," but "curate."

As with the nouns, so with the adjectives, similarity of meaning does not always mean similarity of spelling. Whilst we shall be able in these articles to point out to our readers possible sources of mistake, it must not be thought that a careful reading of them will be sufficient to save a student from error in the future. Nothing but continuous and well-selected reading will guide a student in the correct choice of the words he wishes to use in writing or speaking French. This is a point which is not made enough of in our modern language teaching. The student who keeps up a continuous acquaintance with French literature, and has mastered the peculiarities of pronunciation of the language, will find little trouble in expressing himself in French with fluency and correctness.

Accidenté has nothing to do with "accident" in its ordinary acceptation. It is applied to a stretch of country which presents inequalities. So we may speak of a *terrain accidenté*. In a figurative sense we may talk of a *vie accidentée*.

Bête, used as an adjective, has nothing to do with "beast;" it means "stupid." Thus *il est bête comme une oie*. Thus *une bêtise* is a stupid act.

Confident does not mean "confident" in our sense. In a sense now somewhat out of date it referred to those who receive our confidence. Thus Massillon speaks of *les témoins les plus confidents de notre vie;* and Racine, with a poet's boldness, applies the word to things—*Un geste confident de notre intelligence*. "I am confident of it" would be in French, *J'en suis sûr*.

Disgracié does not mean "disgraced" in a moral sense. In this sense we might speak of a person as *couvert de honte*. The word is used in the sense we ourselves have borrowed from the French of being deprived of some one's favour, as *un ministre disgracié*. There is a more modern extension of its meaning in the phrase *une personne disgraciée de la nature*, which means a person who has some natural defect of mind or body.

Extravagant is not used, as with us, to refer to an undue expenditure of money. In this sense we might use the word *dépensier*. Molière says, "*Vous êtes dépensière, et cet état me blesse.*" In French the word *extravagant* is applied to a person who passes the bounds of common sense in what he says or does. We quote again from Molière, who says, "*Vous êtes, sans mentir, un grand extravagant.*"

(*To be continued.*)

BERCEUSE.

Dors dans ton berceau, petite Mireille,
Comme l'oiselet s'endort dans son nid
Plein d'aube vermeille,
Dors, ta mère est là! Dors, ton père veille!
Dors bien doucement; l'amour te bénit!
Dors dans ton berceau, petite Mireille,
Comme l'oiselet s'endort dans son nid.

Au creux des coussins blottis bien ta tête,
Ceux qui sont petits demain seront grands,
Petite fillette!
Puis en t'éveillant, tu feras risette
A ta grande sœur, bébé de quatre ans.
Au creux des coussins blottis bien ta tête,
Ceux qui sont petits demain seront grands!

CLOVIS HUGUES.

ON FRENCH VERSIFICATION.

IV.

IN our last article we mentioned that the old classical writers, of whom Malherbe and Boileau may be taken as types, strictly forbade two kinds of *hiatus*:—

1. When a sounded vowel at the end of a word clashed with one at the beginning of the next word, as, *Il est sorti à une heure.*

2. When a word ended in the combination of an accented vowel, and either an *e* mute, which could not be elided, or one of the silent endings *es, ent*, as, *La vie nous est chère; ils se soustraient à mes regards.*

The poets of Boileau's time and those of subsequent time did not follow this rule in its strictness. Thus Voltaire says,

"*Demandez aux mourants, dans ce séjour d'effroi,*
Si c'est l'orgueil qui crie: 'O ciel, secourez-moi,'"

where there is a hiatus in *crie: O;* and in André Chénier we find,

"*Ses guides tremblants, incertains,*
Fuyaient. Il fallut donc, dans le péril extrême,"

where the hiatus occurs beween *Fuyaient* and *Il.*

Nor were these rules strictly observed by the poets who preceded Boileau. In a well-known rondel by Charles d'Orléans there occurs the line,

"*Il n'y a bête ni oiseau,*"

where there is a hiatus between *y* and *a.*

The two rules given above do not, however, cover every form of hiatus. A hiatus occurs whenever one vowel sound immediately follows another. Numberless examples of hiatus not forbidden by the rules given above could be quoted. Thus from La Fontaine—

"*Le soleil dissipe la nue*
Recrée, et puis pénètre enfin le cavalier,"

where there is a hiatus between *recrée* and *et;* and from Alfred de Vigny,—

"*J'avais une lunette, exercée aux étoiles,*"

where there is a hiatus between *exercée* and *aux.*

It is obvious, too, that an actual hiatus occurs in the pronunciation of such words as *pri-er, caprici-eux*, the use of which in poetry is not condemned.

Purists have even condemned the occurrence of hiatus in prose, but D'Alembert's condemnation of such finical correctness will meet with general approval. "*Ne devrait-on pas dire que c'est une puérilité,*" says he, "*que le soin minutieux d'éviter les hiatus dans la prose?*"

Before treating the somewhat difficult but interesting subject of the rhythms of French verse, we shall deal with the various combinations of rhyme.

We have explained what is meant by *feminine* and what by *masculine* rhymes. However such rhymes are combined, it is absolutely necessary that a rhyme shall be supplied to the last line having a feminine or a masculine ending before a new rhyme of the same class is commenced. As we have already mentioned, only a line with a feminine ending (that is, ending in *e* mute) can rhyme with another line having a feminine ending, and only a masculine ending (any other than *e* mute) can rhyme with another ending of the same kind. If masculine and feminine endings alternate in pairs, we have what are called *rimes suivies* or *rimes plates*, as in the following example from Victor Hugo:—

"*En partant du golfe d'Otrante,*
Nous étions trente;
Mais, en arrivant à Cadiz,
Nous étions dix."

This is the standard form of alternation of rhyme with Alexandrines. Hence Alexandrine couplets consist of *rimes suivies.* Thus,—

"*Cependant jouissons; l'âge nous y convie.*
Avant de la quitter, il faut user la vie.
Le moment d'être sage est voisin du tombeau
Allons, jeune homme, allons, marche; prends ce flambeau."
André Chénier.

When the successive rhymes are alternately masculine and feminine, they are called *rimes croisées*, as in the following extract from Malherbe,—

"*Si des maux renaissants avec ma patience,*
N'ont pouvoir d'arrêter un esprit si hautain,
Le temps est médecin d'heureuse expérience;
Son remède est tardif, mais il est bien certain."

When a pair of rhymes of one class is included between two of another class, we have *rimes embrassées.*

"*Il ne faut point juger des gens sur l'apparence.*
Le conseil en est bon, mais il n'est pas nouveau.
Jadis l'erreur du souriceau,
Me servit à prouver le discours que j'avance."
La Fontaine.

If masculine and feminine rhymes follow one another without any well-defined sequence, verse is said to be written in *rimes mêlées*, as in the subjoined extract from Molière:—

"*Mais enfin, dans l'obscurité*
Je vois notre maison, et ma frayeur s'évade.
Il me faudrait, pour l'ambassade,
Quelque discours prémédité.
Je dois aux yeux d'Alcmène un portrait militaire
Du grand combat qui met nos ennemis à bas;
Mais comment diantre le faire,
Si je ne m'y trouvai pas?"

(*To be continued.*)

DANCE AND SONG.

RONDEAU is simply a more modern form of the word rondel, just as peau is of pel, chapeau of chapel, etc.....The rondel or rondeau is so named because it was originally intended as an accompaniment to the dance called ronde or rondel, still surviving in the western provinces of France, in which the dancers joined hands and went round in a circle according to the time of the song, the soloist and chorus taking alternate parts, while a minstrel not infrequently accompanied the whole song on a kind of violin called the viole.....From the rondeau there developed the so-called bergerette, which did not survive the first half of the sixteenth century..... The triolet is nothing but a favourite type of the early rondeau.....Like the rondeau, the ballade was originally a dance-song (Prov. *ballar*, to dance).....The chant-royal or chanson royale is a kind of elaborate and grandiose ballade addressed generally to a king or a divinity.....The virelai or chanson baladée, also a dance-song, of which the older and correct name is vireli—the form virelai being due to a false etymology from *virer* and *lai*—is nothing but a bergerette of several strophes.....The lai (Erse *laid*) was a piece of music played on the harp or rotte (a kind of harp), in accompaniment to a song of lyric character in the Keltic language.—From *A History of French Versification*, by L. E. Kastner, M.A.

LES REPROCHES DE LA FÉE.—J'offre la beauté aux jeunes filles, le courage aux jeunes gens, la sagesse aux vieux, la santé aux malades, enfin tout ce qu'une honnête fée peut offrir de bon aux hommes et tous me refusent. "Avez-vous de l'or et de l'argent, disent-ils, nous ne souhaitons pas autre chose?" Je me sauve, car j'ai peur que les roses des buissons ne me demandent des parures de diamants et que les papillons n'aient la prétention de rouler carrosse dans la prairie.

"Non, non, ma bonne dame, s'écrient les petites roses, nous avons des gouttes de rosée sur nos feuilles.

— Et nous, disent les papillons, nous avons de l'or et de l'argent sur nos ailes.

— Voilà, dit la fée en s'en allant, les seules gens raisonnables qui soient sur la terre." G. SAND.

FRENCH PRIZE COMPETITION.

RULES.

1. **All translations should be posted not later than February 8,** and addressed:—PRIZE EDITOR, Office of the *Practical Teacher*, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.

ALTERATION IN RULE 3.

3. Competitors should write pseudonym only on MS. Prize-winner will be asked to send name and address for publication.
4. No competitor may take the prize offered more than once in three months.

A Prize of Half a Guinea is offered for the best rendering into English of the following extract:—

— Pourquoi des gens s'épousent-ils, par une inclination réciproque, s'ils ne sont pas résolus à des tendresses parallèles?

— Des tendresses parallèles,—objecte le baron,—seraient celles qui ne se rencontreraient jamais: celles-là, en effet, ne s'useraient pas à se heurter. Mais, après les noces, on se rencontre tous les jours et on se heurte quelquefois..... Sans jouer sur les mots, je suis bien sûr que le mariage, par ailleurs admirable, est bien ce qu'on a pu inventer de plus rapide pour désabuser les romanesques.

— Oh! oh! parrain,—s'écrie Geneviève,—c'est un célibataire qui parle.

— Et un célibataire qui voudrait bien se tromper, mais qui est dans le vrai. Le mariage serait délicieux s'il durait. Hélas! on ne vit pas en mariage, on vit en ménage. Le mariage est un acte; on peut l'accomplir dans la fougue du sentiment même qui vous entraîne; car un acte est instantané. Mais le ménage est un état; c'est même un état perpétuel et qui subsiste après qu'on s'est réveillé de tous les rêves. Le ménage n'a aucun rapport avec le mariage. Et tous les fiancés confondent l'un avec l'autre! Quel égarement déplorable! Quelle source de désappointements! Et qu'il serait donc prudent d'inscrire en gros caractères, sur les certificats que délivre le maire ou le prêtre aux époux: "Il y a des mariages d'amour, il n'y a pas de ménages d'amour!"

— Ou encore,—propose Geneviève:—"Attention! madame et monsieur, les illusions éternelles sont prohibées."

LUCIEN MUHLFELD.

RESULT OF THE JANUARY COMPETITION.

The prize is awarded to "Chota Pagul." Will "Chota Pagul" kindly send name and address for publication?

First Class.—Traduzco, Fitzthomas, Grenot, Lil, Edzell, Bon-accord, Gianello, Polly, Moss Rose, Monq, C.E.M., La Printanière, Ymp, Agaznog, E.W., Babette, Lorine, C.A.B., Manu forti, Adlitam, Tyro, Ventnor, L'homme qui rit, Eboracum, Festina lente, The Bul-Bul, Fiscal, Pemberton, Bacaud, Desdichado, Gifford, Garryghesta, A Dalryite, Kelso, Esmond, Quædam, Amry, Pickles, Heosary, Stella, Erinnies, Boreas, Kalos, Shakspere, Welburn, Kettering, Cœli, Jean, K.R.C., Jadic, Ceylon, R.B., Hermia, Binnbheul, Vera, Stephen M., Saxonne, Auricaria, Grimbarian, Radium, Woolley, Bam, Colleen, Afgy.

Second Class.—Mac, Flora, Mist, Ey Seye Mhole, J.P.M., Sapho, Ceres, Arouet, Mal, Bec, Une Guernesiase, Cerf-volant, Croissant, 99, Une anglaise, S.A.G., Squib 604, Irene, Killeen, J.B.W.S., Nancy, La Fayette, Stella, H.G.S., Quantum, Whistling Rufus, Katrine, Magnifique, Paris, S.N.D., Marchioness, D.E.L., Janet, Gladiola, Spes, Aberdarian.

Report.

Some very good translations have been sent in, and the majority of the competitors have thoroughly well grasped the drift of the piece set. A few, but not many, found a difficulty with the word *esprit*, giving such renderings as "genius," "cleverness," etc. Although the French word *esprit* does not actually correspond in meaning with the English word "wit," yet the latter is the nearest equivalent for the former. *Abus* also misled some translators, who merely followed the form of the word. The word means "misuse."

Last month about a dozen papers arrived from Scotland about a week after time, and consequently their arrival could not be noticed in our columns.

Prize Translation.

A man who had some knowledge of the human heart was consulted with regard to a tragedy which was about to be produced. He replied, that so much wit was displayed in the piece that he was doubtful of its success. What! you will say, is *that* a fault in an age when every one wishes to possess wit, when people write simply to prove that they possess it, when the public applauds even the falsest sentiments, provided that they are brilliant? Yes, no doubt, people will applaud the first day and feel bored the next. What is called wit is sometimes an unusual comparison, sometimes a neat allusion; now, the misuse of a word, which is put forth in one sense, while it may be interpreted in another; now, a subtle connection between two ideas which have little in common; it is an out-of-the-way metaphor; it is a discovery of something in an object which it does not offer to the first glance, but which is in reality contained in it; it is the art of combining two remote ideas or of separating two which seem to be joined, or of opposing one to the other; it is the art of expressing only half one's thought, so as to leave the whole to be guessed. In short, I would enumerate to you all the various ways in which wit is displayed if I myself had more of it. But all these forms of brilliance—and I do not refer to the spurious kinds—are never, or very seldom, suitable to a serious work, destined to awaken interest. The reason of this is that in such a case it is the author who is seen, whereas the public wishes to see the hero.

CHOTA PAGUL.

MORCEAUX CHOISIS.

Paris pendant le siège.

LA nuit, les rues étaient toutes noires, et pourtant pas un délit. Moi qui parle, toutes les nuits, je traversais seul, et presque d'un bout à l'autre, Paris ténébreux et désert; il y avait là bien des souffrants et bien des affamés: tout manquait, le feu et le pain; eh bien! la sécurité était absolue. Paris avait la bravoure au dehors et la vertu au dedans. Deux millions d'hommes donnaient ce mémorable exemple... Ceux qui l'ont vu ne l'oublieront pas. Les femmes étaient aussi intrépides devant la famine que les hommes devant la bataille. Jamais plus superbe combat n'a été livré de toutes parts à toutes les calamités à la fois. Oui l'on souffrait, mais savez-vous comment? On souffrait avec joie parce que l'on se disait: nous souffrons pour la patrie. VICTOR HUGO.

Saint-Malo.

Saint-Malo, bâti sur la mer et clos de remparts, semble, lorsqu'on arrive, une couronne de pierres posée sur les flots, dont les mâchicoulis sont les fleurons. Les vagues battent contre les murs, et, quand il est marée basse, déferlent à leur pied sur le sable. De petits rochers couverts de varechs surgissent de la grève à ras du sol, comme des taches noires sur cette surface blonde. Les plus grands, dressés à pic et tout unis, supportent de leurs sommets inégaux la base des fortifications, en prolongeant ainsi la couleur grise et en augmentant la hauteur. Au-dessus de cette ligne uniforme de remparts, que çà et là bombent des tours, et que perce ailleurs l'ogive aiguë des portes, on voit les toits des maisons serrés l'un près de l'autre, avec leurs tuiles et leurs ardoises, leurs petites lucarnes ouvertes, leurs girouettes découpées qui tournent et leurs cheminées de poterie rouge dont les fumignons bleuâtres se perdent dans l'air.

GUSTAVE FLAUBERT.

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Late Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

NEW SCHOLARSHIP COURSE FOR DECEMBER 1904.

Second Month—February.

Work to be Prepared.

1. *Reading and Repetition.*—Regular oral practice is essential in each of these subjects. If either is weak, systematic voice-production and enunciation exercises should be taken. The mechanical part of the exercise should be absolutely perfect. Modulation and just emphasis can only come with a full understanding and appreciation of what is read.

2. *Teaching.*—Chap. ii., *Scholarship School Management.* This chapter deals with teaching methods, and, like chap. i., needs careful study. It is absolutely essential that every teacher should know the exact difference between induction and deduction, analysis and synthesis, the various uses of questions, etc. This underlies every lesson, and there is never an oral lesson in which the teacher is not called upon to decide what is the best method of arriving at a new fact. "Telling," of course, is not teaching. The mere imparting of information is not the object of school life, as those who have studied chap. i. will know; but the earnest teacher (he who is not earnest is *no* teacher) endeavours to train and develop the faculties, and to instil into the minds of the children the necessity for self-help. By regular practice in inductive thought, induction becomes a habit, which is far more useful in everyday life than the exact knowledge of numerous details with no power of application. *Questioning* is especially a topic which needs much care.

3. *Drawing.*—One or two copies each week, varied by studies from nature—for example, a flower, a spray of leaves, etc.

The copy set at the recent examination was by no means difficult, but probably many students were caught by the lack of balance of the two sides. Drawing should be a recreation rather than a study. Students are invited to submit copies for criticism.

4. *Music.*—Diatonic and chromatic intervals. The former occur between any two tones of the major scale. A chromatic interval is either larger than the greater, or smaller than the lesser, diatonic. Thus **d** to **m** is a major third, **d** to **ma** is a minor, **de** to **ma** is a chromatic diminished third.

5. *Penmanship.*—Ten minutes' practice per day.

6. *Composition.*—Write one or two essays each week on such subjects as—

(*a*) Any memorable place you have visited.
(*b*) Use of Pictures in Teaching.
(*c*) Colonisation.
(*d*) Electric Telegraph and its Uses.
(*e*) Fruit-trees.
(*f*) Holidays.
(*g*) "Hope springs eternal in the human breast."

Read up the subject if necessary, and prepare a plan on which you write the essay. Never be satisfied, even with your best. A good plan is to get some one to read the essay aloud to you. It is surprising how weak and awkward sentences *sound*, even when they look perfect.

The subjects set at the examination were—

(1.) Describe any historic building which you have visited; or, Write a short essay on *one* of the following:—

(2.) Free libraries: their use and abuse.

(3.) What can be done by the elementary schools to remedy any degeneration in the national physique?

(4.) The advantages and disadvantages of the distribution of the agricultural land of a county among small freeholders.

Of these, (1) and (2) were set during the year. To see how the first can be handled, read Washington Irving's impression of Westminster Abbey in the *Sketch Book*. Both (3) and (4) are rather above the level of the average scholarship student. Physical degeneration cannot be remedied at school. A little may be done by means of properly taught physical drill; but any national degeneracy is brought about by causes which are entirely beyond the teacher's control—the hours and conditions of labour, the character of the home, the flocking into and overcrowding great cities, etc.

The last subject is hardly a fair topic. Unless one has read a good deal of the peasant proprietor system, which prevails in France, etc., it is next to impossible to formulate any theories about it worth putting on paper.

7. *English.*—

(*a*) Twenty-five roots and meanings per week.

(*b*) *Much ado about Nothing*, Act I., Scene i., line 202 to the end of the act.

(*c*) The Essay on Revenge.

(*d*) The changes produced in the language by the Norman Conquest.

(*e*) In addition to the above, all candidates would do well to divide their text-book on grammar into ten or eleven monthly portions, for the purposes of revision. The grammar of the various parts of speech requires somewhat closer study than it usually receives during the earlier years of apprenticeship. Some knowledge of the derivation or the Saxon equivalent is also necessary.

Notes on English.

No one should neglect (*a*) above. If these derivations are learned systematically, it gives one a wide knowledge of the classical and Teutonic roots, which is of the greatest value, not merely from the etymological point of view, but also as giving a far greater command of language. It also renders easy such questions as No. 5 in the last examination.

In studying the play set for this year, I do not propose to attempt anything like a detailed annotation. The text-book recommended covers the ground in an excellent manner, and I shall merely give such explanations of passages as are asked for by students. I would strongly impress upon all readers the necessity of reading the play continually till the text is very familiar. Look upon it as a piece of literature first, as an exercise for parsing and analysis a long way last. Your first object is to understand the general plot of the play, and this is by no means difficult. Watch the various characters, study their peculiarities, imagine the scenes before you, and you will develop a taste for Shakespeare which will render the perusal of the plays a keen pleasure.

The chief interest centres in the two pairs of lovers. Hero and Claudio love truly and passionately, but the course of true love is, as usual, interrupted by the plot laid by the villain of the piece. But it is in Beatrice and Benedick that we are most interested, and they are both the products of that marvellous insight into human nature which rendered Shakespeare not only the greatest dramatist of a great age, but the greatest of all ages and of all countries. The cursory reader might feel a little surprise at the apparently sudden change in both Beatrice and Benedick; but the end is inevitable from the commencement, if the characters are studied. Beatrice's love of banter and raillery is known and felt by all, but it is to Benedick that she gives the sharpest edge of her tongue. He is perfectly ready to answer her in the same vein, but it is evident that, notwithstanding their utterances, each is giving the other a great deal of attention and thought. Beatrice was not the first (or last) girl who, on feeling an affection for some one, endeavoured to hide it and disguise it, even from herself; and the more she becomes attached to Benedick, the less willing is she to admit it. Benedick is an exact parallel. He is attracted to the bright, happy, and witty young lady, but will not own it. His theories of life delivered to his friends are the outcome of the head and not of the heart; and it is, therefore, poetically just that each should have fallen into the trap laid for them. The professed woman-hater is only too frequently the most susceptible of persons.

I received the other day a frank inquiry: "What is the use

of reading Bacon's *Essays*? I have read through all those set, and do not see much in them." It is not unnatural that a student should feel this, though few may express it, and therefore I should like to point out why Bacon's *Essays* are selected for study, and how they should be studied.

Bacon was a great man in an age of great men, although his true worth (as is often the case) was not appreciated till much later. He was an earnest student, a profound thinker, and a wise and wary man of the world. His greatest work was the *Novum Organum*, which first of all pointed out the necessity for careful induction in dealing with science. He discovered no great scientific facts himself, but he pointed out to succeeding ages how they might be discovered. His was not a scientific age. The full value of his teaching was not appreciated for two centuries.

Many people think only of Bacon as the chief-justice who was fined for taking bribes; and Pope's epigram, "The wisest, brightest, *meanest* of mankind," sacrifices historical accuracy for the sake of antithesis. Bacon's learning was such that few of his age were anywhere near him, and it is this fact which has made some people seek to find a reason why he should have written the plays which we call Shakespeare's. Certainly we might have expected to find more power and wisdom in the highly-accomplished student than in the strolling player from Stratford. Whatever a man of such abilities writes must be worth reading, and if little pleasure is derived from a perusal of his works, it is probably because the reader is a long way below the mental level of the writer.

The *Essays* have always been popular. "A man can hardly call himself educated who has not read the *Essays*." They consist of the shrewdest ideas expressed in the tersest language. Take any phrase and paraphrase it, and you will find that you need probably twice as many words to express the same idea.

Each Essay should be carefully analysed (whether this is done in the text-book or not). The various points will then be discovered, and what appeared at first unintelligible and diffuse will become clear and concise. Pages may be filled with sayings in the *Essays* which have grown into household words—"'What is truth?' said jesting Pilate," "Revenge is a kind of wild justice," "Travel is a part of education," "God Almighty first planted a garden," etc. Endeavour, then, to appreciate what you read; if you cannot, it is your fault.

The changes produced by the Conquest are of the highest importance. Note what the native language lost (its power of forming compounds and many of its inflections), and what it gained in vocabulary. Learn the rules by which you can distinguish words of Teutonic origin.

8. *Geography.*—(*a*) India; (*b*) revise Scandinavia, Denmark, the Netherlands, Germany, and Austria. India requires special study. In addition to the ordinary facts of geography, there are many points of extreme importance which the student should appreciate. The history of its gradual conquest, its diversity of races and tongues, religions, castes, etc., its peculiar form of government, the results of the British occupation, the great advance made since the Mutiny in productions, etc.—all are topics of absorbing interest, on which questions may be reasonably expected. Particular attention should be given to what might be called commercial geography—productions and manufactures, imports, exports, lines of communication, etc.

The paper at the recent examination was a very fair one, with a choice of five questions out of eleven. The papers of recent years have shown a commendable modification in asking for useful information rather than mere reproduction of dry facts, and wide reading is necessary. Maps must be drawn continually; nothing will fix the position of a place quicker or more firmly.

9. *History.*—The Norman kings. Points for special attention—(*a*) changes produced by the Conquest in nobility, church, architecture, dress, manners and customs, etc.; (*b*) the Feudal System and its incidents; (*c*) the Investiture dispute; (*d*) Henry's charter; (*e*) the civil war in Stephen's reign, and its results. Do not limit your reading to one book.

As in the case of geography, the paper in history was eminently fair, but calculated to enable thoughtful students to score above those who merely crammed facts. It is a matter of satisfaction that in this, as in other papers, many of the questions were given in this course during the past year.

10. *Arithmetic.*—Fractions, vulgar and decimal, and their application, and Nos. 101-200 of the general examples at the end of the text-book.

An innovation in the arithmetic paper was the absence of any choice of sums. Eleven sums were set to be done in two hours, but the time was ample for those who knew the work. Questions 1, 2, and 3 involved a knowledge of the theory; 2 and 3 have been asked and explained in these columns several times.

Question 8 presented some difficulty: "The sum of the ages of three people is 75 years. Ten years ago their ages were in the proportion 2 : 3 : 4. Find the present age of each."

Ten years ago the total age was 30 years less = 45.
This divided in proportion 2 : 3 : 4 = 10, 15, 20.
Therefore present ages = 20, 25, 30. Ans.

Question 9. "How many square plots of ground, 20 yds. each way, can be marked out on a square field of 10 acres, the front of each plot to be along the boundary wall?"

The area of the field would be 48,400 sq. yds.; the side = 220 yds. This would give 11 plots to each side, or 44 in all, counting the corner squares twice each, or 40 plots. Ans.

Question 11. "Pipe A fills a cistern in half an hour, and B in forty minutes; but owing to a crack in the cistern A now takes forty minutes to fill the cistern. How long will it now take B to fill it, and how long will the crack take to empty it?"

A fills $\frac{1}{30}$ per min.; B fills $\frac{1}{40}$. With the crack A fills $\frac{1}{40}$ per min. Therefore the crack has taken out $\frac{1}{30} - \frac{1}{40} = \frac{1}{120}$ per min., or it would empty in two hours. B fills $\frac{1}{40}$ per min., and crack takes off $\frac{1}{120}$. Therefore amount left $= \frac{1}{40} - \frac{1}{120} = \frac{1}{60}$. Therefore B would fill it in one hour.

11. *Algebra.*—G.C.M. and L.C.M. The importance of factors is fully illustrated by the paper set, in which, as in arithmetic, all questions might be answered. Four questions might be solved easily by factors; for example,—

(2) Multiply together $81x^4 + 16y^4$, $9x^2 + 4y^2$, $3x + 2y$, $3x - 2y$.

This requires the application of the formula $(a + b)(a - b) = a^2 - b^2$.

The product of the last two $= 9x^2 - 4y^4$.
The product of this with the third $= 81x^4 - 16y^4$.
The product of this with the first $= 6561x^8 - 256y^8$.

Divide $27x^3 - 8y^3 - 27z^3 - 54xyz$ by $3x - 2y - 3z$.

This is $(3x)^3 - (2y)^3 - (3z)^3 - 3(3x)(2y)(3z)$ by $3x - 3y - 3z = (3y - 2y - 3z)(9x^2 + 4y^2 + 9z^2 + 6xy - 6yz + 9xz)$ by $3x - 2y - 3z = 9x^2 + 4y^2 + 9z^2 + 6xy - 6yz + 9xz$.

(3.) Solve $\frac{15}{x} - \frac{4}{y} = 3$, $\frac{9}{x} + \frac{8}{y} = 7$.

Do not clear of fractions. Multiply the first equation by 2.

$$\frac{30}{x} - \frac{8}{y} = 6, \text{ and } \frac{9}{x} + \frac{8}{y} = 7.$$

$$\therefore \frac{39}{x} = 13, \text{ or } 13x = 39, x = 3. \text{ Hence } y = 2.$$

12. *Euclid.*—Props. 11-20, with six deductions per week. Six propositions and six riders were set for the two hours. This does not allow of much spare time in thinking deductions out, but these were, on the whole, fairly easy.

13. *Elementary Science.*—Prepare Section III. of the syllabus—The Mechanical Powers.

The questions in this subject were well distributed and fair.

14. *General Information.*—Read up answers to two or three papers in one of the books of questions recommended.

The paper set in this subject was, for the average student, fairly hard. There are comparatively few people who could answer all the questions with absolute accuracy. The following are the questions which may be taken as test questions for the month:—

1. What are the duties of a coroner, churchwarden, pilot, surveyor of taxes, auditor, lunacy commissioner?
2. State very briefly what is meant by the Far Eastern problem, balance of power, Yellow peril, tariff question.
3. What are tithes, excise, assizes, close time, mortgage?
4. What is meant by the terms Classical, Norman, and Gothic in architecture? Mention instances of each style, from your local knowledge, if possible.
5. What foreign countries have been visited by the King during the first half of the present year? What political importance do you attribute to these visits?
6. Describe the flags known as the "Union Jack," white ensign, blue ensign. What vessels fly the white and what the blue ensign?
7. Sketch the cross section of a rail used on a railway line. Describe the arrangements by which the rails are kept in position.
8. In what sense are the words "premium" and "policy" used in connection with life insurance? How do you explain the fact that premium rates vary in different circumstances?
9. Mention three or four machines used in agriculture. State the use of each. Explain very briefly the action of one of them.
10. Name one famous poet of each of the following nationalities, and state the title of one work by each poet—French, German, Italian, Portuguese, Greek.
11. Explain five of the following terms—Auto-da-fé, Skuptchina, Maffia, Vatican, Vendetta, Fetish, Cortes, Monroe Doctrine.
12. Distinguish between the rigs of the following vessels—barque, brigantine, full-rigged ship, schooner, yawl, cutter.

Test Questions.

(These are marked monthly for a fee of 1s. The answers must be sent direct to Mr. A. T. Flux, Oakleigh, Belvedere.)

1. Write as specimens of copy setting—
   Large hand—*Horizontally.*
   Small hand—*Blow, bugles, blow! set the wild echoes flying.*
2. Write an essay on "How has rapid communication affected our food supply?"
3. Why does a child remember better what he has seen than what he is merely told about?
4. Write a short synopsis of the plot of *Much Ado About Nothing.*
5. Why are the nations of Central Europe more powerful than those of Southern Europe?
6. Point out the importance as possessions of Hong-Kong and Singapore, and give some account of the trade carried on at each.
7. To what extent did a feudal system exist before the Conquest? Why were the Saxons so easily overcome by a small army of Normans?
8. Write brief accounts of two of the following—Edric Streone, Lady of the Mercians, Caedmon, Sweyn, Asser, Edmund Ironside.
9. Point out any rules you use in endeavouring to find a factor of a given number. What is the largest number you would try as a possible divisor of 539, and why?
10. Explain the following as to a class: If a measures b and c, it also measures $mb \pm nc$.

PUPIL TEACHERS' COURSE.

For Candidates' Examination, 1904.

1. *Reading, Repetition, and Penmanship.*—Ten minutes' practice daily. These are important subjects, especially to young students, and must on no account be neglected.
2. Finish the *Ode on Spring.* Revise the Teutonic suffixes.
3. *Arithmetic.*—Simple proportion.

The theory underlying this must be clearly understood.

Ratio is the relation existing between two quantities *of the same kind* with regard to magnitude, and is usually expressed 3 : 4. There can be no ratio between quantities of different kinds—for example, it is impossible to express any ratio between 3 books and 6 shillings.

Proportion is the equality of two ratios, and is expressed as 3 : 4 :: 6 : 8. Each ratio must be between quantities of the same kind. Hence we cannot say as 3 books : 6 shillings :: 4 books : 8 shillings; it must be as 3 books : 4 books :: 6 shillings : 8 shillings. This fact must be thoroughly understood; it is one which children frequently fail to understand.

When four terms are in proportion, the product of the extremes = the product of the means. It is by this law that sums are solved by proportion. If three terms are given, the fourth may always be found. The unknown term need not be the last, but may be any one of the four—for example, 3 : ( ) :: 6 : 8; 3 : 4 :: ( ) : 8; ( ) : 4 :: 6 : 8; 3 : 4 :: 6 : ( ). Candidates should be prepared to solve sums either by method of unity or by proportion. The method of unity consists in finding the value of 1, etc., from the given ratio, then the value of the required quantity—for example, if 3 books cost 6s., what would 4 cost?

By proportion—As 3 books : 4 books :: 6s. : required amount.

Hence $\frac{4 \times 6s.}{3} = 8s.$ Ans.

By method of unity—Cost of 3 books = 6s.
Cost of 1 book = 2s.
Cost of 4 books = 8s.

4. *Geography.*—The general features of Asia. Draw a sketch-map. Enter all places to be remembered, and repeat the map till the whole is known.
5. *History.*—George the First, George the Second, and George the Third to 1783.

Chief points:—Learn a genealogical table of the Hanoverian descent. The attempts of the Stuarts in 1715 and 1745 to regain the throne. The Riot Act and Septennial Bill. The South Sea Scheme. Life of Walpole, and some knowledge of his methods of government. "Wood's Halfpence." The Spanish War. The War of the Austrian Succession. The Seven Years' War: its causes and results (note especially affairs in India and North America). The War of American Independence.

6. *Elementary Science.* Revise the next two chapters in text-book.
7. *Music.*—Revise all, and work through any questions previously set.

Test Questions.

1. Analyse the first verse of the *Ode on Spring*, and parse the words *where, train, awake, responsive, untaught, harmony, while.*
2. Express the meaning of the Epitaph in the *Elegy* in your own words.
3. Explain the meaning of the suffix *en* in the following: written, oxen, golden, brighten, vixen, maiden.
4. What is the great Central Plain of Europe. What rivers flow through it?
5. Give a list of the chief islands in the Mediterranean, and say what you can of *two* of them.
6. Point out any changes produced by the revolution of 1689.
7. Write some account of the Duke of Marlborough. What battles did he win?
8. Under what circumstances was Scotland united to England?
9. What is the primary unit of length in the metric system? How are the other units derived from it?
10. Select pairs of notes from **t$_1$, d, m f s l t,** to form (1) imperfect fifth, (2) pluperfect fourth, (3) major third, (4) major fifth, (5) minor sixth.

First Year.

1. *Reading, Repetition, and Penmanship.*—Regular daily practice must be taken in each of these subjects.
2. *English.*—Cowper's *Expostulation*, lines 282-320; or *The Task*, Book V., lines 283-320.

Paraphrase and analyse the whole. Parse any word presenting difficulty. Learn the derivations of the chief words. Revise the prefixes.

3. *History.*—Revise history up to end of Norman Period.
4. *Geography.*—Finish the geography of Asia.
5. *Arithmetic.*—The Metric System. This is fully explained in the text-book. Note particularly that in square measure the table goes by 100's, and in cubic measure by 1000's.
6. *Science.*—Revise any weak part.
7. *Euclid.* Props. 29 and 30, with four deductions per week.
8. *Algebra.*—Continue exercises in fractions.

Test Questions.

1. Write a short essay on Cowper's Friends.
2. Explain the meaning of the following words by etymology: impending, inanimate, successful, translation, confusion, subterranean.
3. Why was the Armada sent against England? What were the results of its defeat?
4. Write a life of Mary Queen of Scots. Was her execution justifiable?
5. Say what you can of Persia under these heads: (1) boundaries; (2) productions; (3) towns; (4) government.
6. Afghanistan is sometimes called a "buffer state." Explain this fully. What are the chief passes leading from it to India? Mention any historical facts connected with any of them.
7. If a spot in a piece of white blotting paper is wetted and the paper held between the eye and the light, the spot appears brighter than the rest; if the eye is between the light and the paper, the spot appears darker than the rest. Explain this.
8. Write the following in the first sharp remove:—

r m fe s l t d^1 l s fe s r^1 t l s.

Second Year.

Those who were second year last year will now commence the Scholarship Course for next Christmas.

NATIONAL SOCIETY FOR PROMOTING THE EDUCATION OF THE POOR IN THE PRINCIPLES OF THE ESTABLISHED CHURCH.

Instituted 1811.

NATIONAL SOCIETY'S DEPOSITORY,
Sanctuary, Westminster, S.W.

DEAR SIR,—It has lately been brought to my notice through trustworthy channels that statements are being circulated that the National Society is about to close its depository, which has been for so many years one of the principal establishments for the supply of school books and materials of every description to the Church Schools throughout the country.

The reason of such reports being spread abroad is obvious, and I wish to give a most emphatic denial to them.

I shall be grateful if you will kindly insert this letter in your columns, in order that our friends who are so much interested in the work of the National Society and its depository may not be misled by such false statements.—Yours faithfully,

J. S. BROWNRIGG,
Secretary.

THE EDITOR, *Practical Teacher.*

OUR CERTIFICATE COURSE FOR 1904.

BY GEORGE COLLAR, B.A., B.SC.,

Head-master of the Stockwell Pupil Teachers' School.

TEST QUESTIONS ON LAST MONTH'S WORK.

THEORY OF TEACHING.

1. Give the substance of Froebel's teaching on the subject of boys' games.
2. What does Froebel consider as the chief faults of boyhood, and how does he recommend them to be treated?
3. What are the chief points to bear in mind in teaching history? In what ways can the teaching of history and of geography be combined?

ENGLISH LANGUAGE AND LITERATURE.

1. What are the chief traits in the character of Henry the Fifth as delineated in the play? Illustrate your answer by apt quotations.
2. Sketch the types of officers and men in Henry the Fifth's army as shown in the play.

ENGLISH HISTORY.

1. Give a short account of the different campaigns in the Civil War of Charles the First.
2. Write an account of the personal character of Oliver Cromwell, and sketch his foreign policy.
3. What were the chief constitutional questions involved in the quarrel between Charles the First and his Parliaments?

GEOGRAPHY.

1. Describe in as full detail as possible some of the chief journeys of discovery in Africa.
2. Write an account of the Nile. Mention any great works executed in or near its lower course, and show the importance of the river to the prosperity of Egypt.

ARITHMETIC.

1. Explain what is meant by *true* discount.

A bankrupt's liabilities amount to £3,150, and his assets consist of £819, 13s. 5d. in cash, and an undiscounted bill for £600 due four months hence. Find, to the nearest penny, how much he can pay his creditors in the £, the rate of interest being 3 per cent. per annum.

2. Compare the interest on £247, 10s. at 5 per cent. for two years with that on £375 at 3¾ per cent. for the same time.
3. A man sailed from England on the 1st January 1881, leaving a sum of money at his banker's at 3½ per cent. simple interest. On the 1st July 1885 he returned, and found £549, 16s. 3d. standing to his credit. How much of the sum is interest and how much is principal?

ALGEBRA.

1. A straight line 5 inches long is divided so that one part is a mean proportional between the whole line and the other part. Find, correct to the second decimal place, the length of the longer part.
2. State what is meant when one quantity is said to vary as another quantity, and give an example.

It is known that x varies directly as y and inversely as z; it is also known that x is 11 when y is 300 and z is 30: find the value of y when x changes to 12 and z to 29·7.

EUCLID.

1. Inscribe a circle in a given triangle. If a new triangle be cut off by a line parallel to the base and passing through the centre of the inscribed circle, the perimeter of this triangle will be equal to the sum of the two sides of the first triangle.
2. What are the three main steps in the demonstration of Book IV. 10? PQR is a triangle inscribed in a circle, and having each of its angles at the base double of the third angle; the base angles are bisected by QST and RSV, which meet the circle described about the triangle at T and V respectively. Show that the figure PTSV is a rhombus.

ELEMENTARY SCIENCE.

1. Name some animals that use their tongue in seizing their food, and show how that organ is specially modified in each case.
2. Why are the teeth of mammals regarded as important in classifying them?

NOTES AND SYLLABUS FOR FEBRUARY.

ENGLISH COMPOSITION.

Prepare essays on the following subjects:—

1. Friendship.
2. The Training and Use of Memory.
3. British Wild Birds.
4. Poultry-keeping.

THEORY OF TEACHING.

Study the eleventh chapter of Collar and Crook's *School Management*, on the teaching of geography. We must also refer our readers to the various articles which have recently appeared in the *Practical Teacher* on the subject of teaching geography, or of teaching some special points in geography, such as the articles on "Long-Distance School Journeys," "Observations on the Sun," and "Map Drawing."

The great thing in teaching geography is to make the work as practical as possible; and as the measurement and recording of distances form a very important part of some sections of the subject, care must be taken to give the children a real idea of the units of length. It is surprising what a hazy idea most people, even adults, have of the magnitude of a mile or of an acre.

Clay-modelling is practised in most of our schools, and may well be combined with geography. In quite the lowest classes relief models may be made to illustrate definitions, in the middle section of the school relief maps may be constructed, and the older the children the greater the accuracy demanded in the proportions. In the top class some of the boys may be set to construct a relief map from a contour map. This is done by tracing the contour lines on to a sheet of paper, and rolling out the clay to a uniform thickness—say one-eighth of an inch—and cutting this to the pattern of the largest contour line. The paper on which the contours have been traced should be cut first as a guide to cut the sheet of clay. The outer part of the paper can then be cut away, so as to bring it down to the next contour line; and this can be used for cutting the next layer of clay, which must be placed in proper position over the first. The paper can be trimmed again and again until it is so soiled as to be useless, or until the map is finished. Cardboard may be used instead of clay. It is harder to cut, but easier to manipulate when it has been cut. It is not an easy matter to transfer the layers of clay from the board on which they have been rolled to the model. Contour maps are not used nearly as much as they ought to be in teaching geography. When they are used the lines are often merely employed to determine the altitude of a given spot, and even such a simple fact as the relation between the closeness of the lines and the steepness of the slope is seldom insisted upon. Children in the upper part of the school should be exercised in drawing sections of the country from the particulars supplied in the contour map. To do this the pupil should take a piece of squared paper as long as the distance between the two ends of the section. He may then lay one edge of this along the line the section takes on the map, and mark all the points at which it crosses the contour lines. Having decided upon a scale, which will be influenced by the ruling of the squared paper, he will make a dot in accordance with the height of the contour line as shown on the map. Thus the paper is probably ruled in tenths of an inch. In such a case it will be convenient to let a tenth of an inch denote fifty or a hundred feet, or whatever may be the difference in height represented by two successive contour lines. By joining the points thus found the section will be completed, and a few such exercises will enable the pupil to grasp the relief of a country by looking at a contour map. The section need not be taken straight across the country. It is a useful exercise to work out the slopes on a road in the same way; but in this case, instead of applying the edge of the squared paper to the road, it is better to transfer the distances between the intersections of the road and contour lines with a pair of dividers.

Children should all be able to draw a plan of their school and a sketch-map of their school district. The converse study is also important. From a plan or a sectional map children should be able to find their way about a building or a district.

It is important to remember that in a scientific study like geography qualitative observations are not sufficient, and wherever it is possible the quantities should be accurately measured and the results expressed numerically. Thus it is not sufficient to show children that the sun rises higher in summer than in winter; the observation must be pushed on further, so as to discover by how much. The observations are easily recorded by marking the positions taken up by the shadow cast by a

spot on the window (see the article in last month's issue), and the angle between this spot and the highest and lowest positions of its shadows can be measured. It will be found to be 47°, which is the distance between the tropics, and consequently 23½°, or a half of this distance, gives the distance of each tropic from the equator, the distance of the Arctic and Antarctic circles from the poles, and the obliquity of the ecliptic. A reference to the terrestrial globe will drive these relations home. Graphic methods of taking records are now to the front, and large numbers of geographical facts can be recorded in this way. With the help of a few sheets of squared paper the whole class can be employed in recording particulars in this most impressive way.

Study also the *Student's Froebel*, Section IV.—School. Froebel begins by defining the special part to be played by the school in a boy's education—namely, to give him an inward and spiritual view of things—and he forcibly says, "School is not truly such by being an establishment for the acquisition of a greater or less quantity of varieties—that is, externalities—but *by virtue of the living intellectual atmosphere which animates the whole*, and in which all things move." He sets down faith and trust, hope and presentiment, as the chief feelings with which a child enters upon his school life. If the teacher is worthy of his post, this faith and this trust will grow; and it is remarkable what unbounded faith a child will place upon the mere word of his teacher. In vain will his parent try to point out that the teacher has made a mistake, or that the child has not properly understood what was said; the mere fact that the teacher made the statement, or the child understood him to make it, is enough to secure his implicit acceptance. This confidence which a child reposes in his teacher is a most important factor in teaching, and gives the teacher an immense advantage. At the same time it brings a great responsibility. A teacher must always be on his guard lest he should do or say anything to shake the implicit confidence that his children naturally place in him. With regard to the "presentiment," we think that Froebel does not give sufficient consideration to the impressions that have been made on the child's mind before he goes to school. He has had in nearly every case descriptions of the school given him by elder brothers and sisters, or by playmates, who have had experience of school life, and these too often conflict with any presentiment the child may have that in school "he will get food for his mind and soul." Although mischief is not to be permitted, it must be regarded as due to excess of that life and energy which every properly-constituted boy or girl should bring to school with him. The teacher's duty is not to check this energy, but to direct it into fit and profitable channels. "A genuine schoolboy ought not to be lazy and listless, but fresh and lively, vigorous in soul and body."

Froebel sums up the object of the instruction given in school as being "to lead the boy to a threefold knowledge, which again is one: (1) to the *knowledge of himself* in all circumstances, and thus to a knowledge of man in general, in his being and relations; (2) to the *knowledge of God*, the constant condition, the eternal foundation and source of all being; and (3) to the *knowledge of nature*—the material world, as issuing from and conditioned by the eternally spiritual. Instruction—that is, school—is to lead man to a life and conduct in complete accord with that threefold yet single knowledge." The section on religious instruction is particularly worthy of attention at a time when so much controversy is raging on the subject out of school. Froebel recognises that religion does not consist in the memorising of set formulæ, but in the application of a knowledge of God to the discharge of our duties to each other. The head-master of a large public school, in an address to students leaving a training college, told his hearers that the best way to give religious instruction consisted in trying to get a religious atmosphere into the school, and Froebel seems to base his religious instruction on St. John's tests—"If a man say, I love God, and hateth his brother, he is a liar: for he that loveth not his brother whom he hath seen, how can he love God whom he hath not seen?"

Froebel makes the study of nature a corollary to the study of religion. This view is seldom put forth by the advocates of "nature study" nowadays, and it is probable that the too earnest attempt to press the two into relation may mar the effectiveness of one or the other, if not of both. The advocacy of the weekly walk in the fields and lanes is distinctly good, especially the stress laid on its effect in binding together both teacher and pupils. There is much in the advice not to fear to take children to study nature because of one's own ignorance. "If you know nothing, do as the child does—go to father and mother; be a child with your child, a scholar with your scholar; and with him let yourself be taught by Mother Nature."

Froebel's advocacy of mathematics is neither very long nor very well reasoned out. He probably thought the necessity would be recognised and accepted as an axiom, "for human intellect is as inseparable from mathematics as human heart is from religion." We shall finish the discussion on curriculum next month.

English Language and Literature.

Make a careful study of the second book of the *Golden Treasury*. The student may ask what is included in the phrase "general reading" in the syllabus. The answer is best given by referring to the questions on the *Golden Treasury* set at the last Certificate Examination. "Name the authors of any *four* of the following extracts, and show by further quotation or reference to the context that you are acquainted with the poems from which they are taken. (You are *not* required to write notes on the extracts themselves.)" Then follow seven quotations from poems in the *Treasury*.

"Who were the chief lyric poets of the eighteenth century? Show by quotations, or by some account of the subject-matter, that you are acquainted with some of the principal lyrics of any one of them."

We do not advise our readers to prepare detailed biographies of all the poets whose verses appear in the collection, but the following points should be remembered if possible: (*a*) dates of birth and death, (*b*) chief poems, (*c*) contemporaries, and especially his personal friends among poets and politicians.

The second book of the *Golden Treasury* concerns itself with Milton and his contemporaries. The details of Milton's life are doubtless well known, but it should be remembered that his literary work falls into three distinct periods—(*a*) that of the Latin poems, *L'Allegro*, *Il Penseroso*, the *Hymn on the Nativity*, *Lycidas*, and *Comus*, together with the fragments of the *Arcades*; (*b*) that of the pamphlets written when he was engaged in politics; (*c*) the period of retirement in which he wrote *Paradise Lost*, *Paradise Regained*, and the tragedy of *Samson Agonistes*.

The *Hymn on the Nativity* is fittingly placed as the opening poem in this book, for it marks a great development in English lyrical poetry. Although there are many short and beautiful poems in the first book, there is nothing so elevated as this poem. We would specially direct attention to the poetic beauty of the stanzas beginning "No war, or battle's sound;" "But peaceful was the night;" "Ring out, ye crystal spheres;" and from "The oracles are dumb" to the end, although much of the beauty of the last group is lost on those who are not familiar with the allusions.

In our discussion on the sonnet in connection with the first book, we showed that Shakespeare and his contemporaries did not observe the strict Italian form of the sonnet, but generally wound up with a riming couplet. Milton was mainly influential in reforming this practice, and bringing the sonnet back to its original Italian form. The sonnets are almost the only poetry Milton wrote during his third literary period, and he seems to have poured all his pent-up poetic fire into their narrow compass. The following sonnet by Wordsworth is well worth committing to memory in connection with the sonnet in general, and Milton's use of the sonnet in particular:—

"Scorn not the sonnet: critic, you have frowned,
Mindless of its just honours! With this key
Shakespeare unlocked his heart; the melody
Of this small lute gave ease to Petrarch's wound;
A thousand times this pipe did Tasso sound;
With it Camöens soothed an exile's grief;
The sonnet glittered a gay myrtle leaf
Amid the cypress with which Dante crowned
His visionary brow; a glow-worm lamp,
It cheered mild Spenser, called from Faery-land
To struggle through dark ways; and, when a damp
Fell round the path of Milton, in his hand
The thing became a trumpet, whence he blew
Soul-animating strains—alas! too few."

Of the other writers whose works belong to the second book the brightest is Herrick, whose poems were arranged in two books, the *Hesperides* and *Noble Numbers*. In the former he deals with flowers, superstitions, love subjects, and folk-lore, and in the latter with religious subjects. The subjects are often commonplace, but Herrick has a peculiar way of finding a happy phrase or a suitable simile to set them off and give an exquisite charm to them.

Carew and Crashaw, as well as Herrick, belong to the Court or "Cavalier" Poets. Carew has not left much; but in each of his poems there is a delightful swing and rhythm, and the contrasts are well brought out. The metaphors and other figures are put into apt relation with the subject proper.

Crashaw's poetry is of very uneven merit. His masterpiece, *The Flaming Heart*, opens with weak and commonplace work, but finishes with a truly inspired passage. When a student at

Cambridge he is said to have described the miracle of Cana in the epigrammatic phrase, "Vidit et erubuit nympha pudica Deum" (The modest water-nymph saw her God and blushed).

George Herbert is represented by only one poem. His poems were mostly sacred in character, and were published in a volume called *The Temple*. There is an evenness and absence of poetic extravagance in them, and yet there is a pleasing quaintness about their diction which appeals to the hearer.

Henry Vaughan followed Herbert in trying to make use of poetical forms and attractions for sacred purposes, and many of his poems show great originality and depth. This is shown in the beautiful little poem (cl., *A Vision*) describing eternity, and in *The Retreat*, which many consider to contain the suggestions for Wordsworth's well-known ode.

Lovelace and Suckling were both Cavalier poets, and both lost large fortunes in the king's cause, and died in poverty. Their general work was spoiled by being applied to obscure topics which were popular in their time, and by a want of care in revising the forms; but the four poems included in our specimens are among the finest specimens of English song writing.

Dryden is represented by two of the finest odes ever written. The union of sound and sense in the *Song for St. Cecilia's Day* makes it quite unique. But, on the whole, Dryden does not rank among our song writers; for although no less a musician than Handel has set these two odes to music, that does not make them "lyrical," any more than the libretto of an opera or oratorio can claim to be. They really belong to a higher plane.

We are sure that much real enjoyment will be obtained by the thoughtful perusal of this second book, illustrating as it does English poetry when chivalrous love was one of its chief subjects.

History.

Study the history of England from 1660–1714. Notice how the old alliance between England and Holland, which was brought about by the necessity of meeting a common foe, gave place to rivalry, due principally to trade competition. Trace the religious movements and the laws dealing with religious questions. The relations between politics and ecclesiastical matters must be carefully noted, in order to obtain a clear understanding of the history of this period.

The campaigns of William the Third in the Netherlands must be followed out on a map, and so must the important campaigns of the Duke of Marlborough. In the War of the Spanish Succession very little attention is paid, as a rule, to the campaigns in Spain itself, where, although Gibraltar was captured and held against great French and Spanish forces, and although Peterborough and Galway scored some successes to begin with, yet the net result was most decidedly in favour of the French; for the Duke of Berwick completely defeated Galway at Almanza in April 1707, and Vendôme defeated Stanhope at Brihuega and Starhemberg at Villaviciosa in 1710, and these French successes completely made up for their losses at Ramillies and Malplaquet.

Geography.

Finish the geography of Africa, and notice particularly the extent to which the different parts are under European influence or control.

Arithmetic.

Study the chapters on profit and loss. The common fault in working examples in profit and loss consists in taking an unnecessarily large number of steps. Every buying or selling price can be expressed as a percentage of the original cost price, and thus a proportion is easily established. The examples worked out in chap. xxxix. will illustrate the direct way of treating nearly every example that can be set.

Algebra.

We shall this month solve some of the questions that have been recently set.

1. Find the factors of $xy + z^2 - xz - yz$.

Hence, or otherwise, simplify—

$$\frac{a+b}{ab+c^2-ac-bc}+\frac{a+c}{ac+b^2-ab-bc}+\frac{b+c}{bc+a^2-ab-ca};$$

$$xy+z^2-xz-yz=z^2-xz-yz+xy$$
$$=z(z-x)-y(z-x)=(z-x)(z-y).$$

Since the denominators of the fractions are of the same form, we have—

$$\frac{a+b}{(c-a)(c-b)}+\frac{a+c}{(b-a)(b-c)}+\frac{b+c}{(a-b)(a-c)};$$

that is, $$\frac{a+b}{(a-c)(b-c)}-\frac{a+c}{(a-b)(b-c)}+\frac{b+c}{(a-b)(a-c)}$$

$$=\frac{(a+b)(a-b)-(a+c)(a-c)+(b+c)(b-c)}{(a-c)(b-c)(a-b)}$$

$$=\frac{a^2-b^2-a^2+c^2+b^2-c^2}{(a-c)(b-c)(a-b)}=0.$$

2. Find the factors of

$$(x-2y+z)^2-(y-2z+x)^2+(z-2x+y)(2z-x-y).$$

Taking the difference of the two squares as the product of the sum and difference of the quantities, we have

$$(2x-y-z)(3y-3z)+(z-2x+y)(2z-x-y).$$

Multiplying the last term by -1×-1—that is, each factor by -1—we obtain

$$(2x-y-z)(3y-3z)+(2x-y-z)(x+y-2z),$$

which equals $(2x-y-z)(x+4y-5z)$.

3. Prove that if a, b, c, d are in continued proportion,

$$7a+5d:8a-3d::7a^3+5b^3:8a^3-3b^3.$$

Notice that the four terms are in *continued* proportion—that is, $\frac{a}{b}=\frac{b}{c}=\frac{c}{d}$. Let each of these fractions $=k$. Then $\frac{a}{b}\times\frac{b}{c}\times\frac{c}{d}=k^3$—that is, $\frac{a}{d}=k^3$, or $a=k^3d$. Similarly, $\frac{a^3}{b^3}=k^3$. $\therefore a^3=k^3b^3$. Substituting these values for a in the first ratio, and a^3 in the second, we obtain $\frac{7k^3d+5d}{8k^3d-3d}::\frac{7k^3b^3+5b^3}{8k^3b^3-3b^3}$, which, on cancelling the first by d and the second by b^3, are seen to give the identical result $\frac{7k^3+5}{8k^3-3}$.

4. Solve the equations—

$$\frac{x}{a^2}-\frac{y}{ab}=1;\ \frac{x}{ab}+\frac{y}{b^2}=1.$$

The best plan is to multiply both sides of the first by a, and both sides of the second by b.

$$\therefore \frac{x}{a}-\frac{y}{b}=a, \text{ and } \frac{x}{a}+\frac{y}{b}=b.$$

By addition, $\frac{2x}{a}=a+b$. $\therefore x=\frac{a(a+b)}{2}$.

And by subtraction, $\frac{2y}{b}=b-a$. $\therefore y=\frac{b(b-a)}{2}$.

Also solve $\frac{2x-\frac{1}{2}}{6x-\frac{1}{2}}=\frac{x-\frac{1}{4}}{3x-\frac{1}{8}}$.

Multiplying by the L.C.M. of the denominators,

$$(2x-\tfrac{1}{2})(3x-\tfrac{1}{4})=(x-\tfrac{1}{4})(6x-\tfrac{1}{4}),$$
$$6x^2-\tfrac{3}{4}x+\tfrac{1}{16}=6x^2-\tfrac{3}{4}x+\tfrac{1}{4}x+\tfrac{1}{16},$$
$$\therefore(\tfrac{3}{4}-\tfrac{1}{4})x=\tfrac{1}{16}-\tfrac{1}{16}.$$
$$\tfrac{1}{16}x=\tfrac{1}{8}\tfrac{1}{6}.$$
$$\therefore x=\tfrac{1}{4}.$$

Geometry.

1. The perpendiculars drawn from the three vertices of any triangle to the opposite sides are concurrent.

The best way to prove this is to take two of the perpendiculars on to the opposite sides, and then draw a line from the third angle through their point of intersection, and prove that it is perpendicular to the third side.

2. Describe a circle about a given triangle. ABC is an equilateral triangle inscribed in a circle. At A, B, and C tangents QR, RP, and PQ are drawn. Prove that PQR is also equilateral, and that its area is four times the area of ABC.

This is merely a combination of three or four simple theorems that have been worked as deductions. (*a*) The line drawn at right angles to the base of an equilateral (or isosceles) triangle through its middle point bisects the opposite angle (I. 4 or I. 8). (*b*) It must also pass through the centre of the circumscribed triangle (III. 1, cor.). (*c*) Consequently the tangent through the angular point is at right angles to this (III. 18), and is consequently parallel to the opposite side (I. 28).

Hence we can easily show that PQR is equilateral, and the original triangle is half of either of the parallelograms ABPC, BCQR, or CARB, and consequently the triangle PQR is made up of four triangles each equal to the triangle ABC, and hence its area is four times the area of ABC.

Elementary Science.

Prepare a comparative account of the organs—lungs, gills, skin—for the oxidation of the blood, and the ways in which different animals carry on the function of respiration.

OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

PHYSIOGRAPHY.

(STAGES 2 AND 3.)

The Stratified Rocks.—The stratified or aqueous rocks most commonly occurring are classified in the accompanying table.

TABLE OF STRATIFIED ROCKS.

	SILICEOUS.	ARGILLACEOUS.	CALCAREOUS.	CARBONACEOUS.
I. Mechanically formed (sedimentary or fragmentary).	Sand. Sandstone. Pebbles. Gravel. Grit. Conglomerate. Breccia.	Mud. Silt. Mudstone. Marl. Clay. Clay slate. Shale.	Coral sand. Shell gravel.	
II. Organically formed.	Tripoli. Sponge spicula. Radiolarian earths.	Red clays of deep seas?	Ooze. Chalk. Gypsum. Coral reefs. Oolitic and other limestones.	Peat. Lignite. Coal. Anthracite. Graphite.
III. Chemically formed.	Flint. Chert. Sinter.	Kaolin.	Stalactites. Stalagmites. Travertine (Tufa). Calcareous nodules and concretions.	

The Arenaceous Rocks.—Most sands consist of small fragments of quartz. In some cases the grains are perfectly rounded, and this appears to be due to attrition produced by the wind. Such sands are known as *millet-seed sand*. Sometimes sands are found where the grains have the shape of quartz crystals (*crystalline sands*). The original shape of these grains was irregular, as the microscope generally shows the original grain imbedded in the quartz crystal. The crystalline form seems to be due to the deposition of silica on them from solution in water. Sometimes, when the grains of sand are all of approximately the same size, they give out a musical note when trodden on. The note appears to be due to the rubbing together of the uniform grains. If we grind up such a sand so as to break the grains, it no longer gives the note; but if the fragments are sifted so as to obtain a number of the same size, the note can be again produced. These sands are known as *musical sands*. Sometimes felspar and mica are found associated with quartz in sands. Such sands are usually the result of the disintegration of granite, and are known as *granitic sands*. If a granitic sand becomes consolidated it is then known as an *arkose*. Some sandstones, fairly common in the older formations, are of a greenish-gray grit or flagstone, and are spoken of as *felspathic sandstones*, or *greywackes*.

Gravels are mixtures of fragments of various sizes, and may be divided into angular, sub-angular, and rounded gravels. When an angular gravel becomes consolidated, it is known as a *breccia*. A consolidated rounded gravel is known as a pudding-stone, or *conglomerate*.

Sandstones consist of sand grains consolidated by pressure or cemented together by silica, carbonate of lime, or oxide of iron, and may be classified as siliceous, calcareous, and ferruginous sandstones. When the particles of a sandstone are coarse and angular, it is known as a *grit*. If the grains are cemented by silica into a hard compact mass which breaks with a conchoidal fracture, then we have a *quartzite*. *Greensands* are sandstones containing particles of silicates (glauconite, etc.), which are casts of the interiors of small organisms.

The Argillaceous Rocks consist of mud and clay and the corresponding consolidated forms. The terms *mud* and *silt* are applied to the finely-divided matter which settles in calm water.

Clay is somewhat similar, but is more compact and plastic, and consists of more or less impure aluminium silicate.

Kaolin, or porcelain clay, is the name applied to the purest form of clay, consisting of silica 46 per cent., alumina 40 per cent., and water 14 per cent. *Fuller's earth* is very similar to kaolin, but contains more water and appreciable quantities of impurities, such as oxides of iron, calcium, and magnesium. Many of the deep-seated clays have a dark blue colour when freshly dug. This is due to finely-divided disulphide of iron. On exposure to air the ferrous compound oxidises, and we get red, yellow, and brownish colours, due to hydrated oxides of iron which are formed.

Marls are impure clays containing considerable quantities of calcareous matter.

Consolidated clays which do not show any lamination are called *mud-stones*, but if they split along the planes of bedding they are called *shales*. If they split along other planes distinct from the bedding planes, as is the case with some which have been altered by pressure, they are called *clay-slates*.

The Calcareous Rocks.—*Coral-sand* is the result of the breaking up of coral limestone, and *shell gravel* the result of the breaking up of shells by the action of water. The basis of all limestones is calcium carbonate. Magnesium carbonate is often found associated with it, and when the amount is considerable, we speak of the limestone as *magnesium limestone*.

Dolomite is a definite chemical compound of calcium carbonate and magnesium carbonate. When the percentage of magnesium carbonate is high, a limestone is scarcely affected by cold dilute acids, but effervesces with warm acid.

Nearly all limestones are of organic origin. *Chalk* is a very soft variety, formed chiefly through the agency of foraminifera. Other foraminiferal limestones are the *nummulitic limestones* and *fusilina limestones*. *Entrochial limestones* consist chiefly of the stems of crinoids.

Oolitic limestones are made up of round grains much like the roe of a fish. If the grains are large, then the name *pisolite* or *pea-grit* is used. The grains appear to be due to the deposition of calcium carbonate around minute plants (algæ).

Tufa, or *travertine*, consists of calcium carbonate deposited from the water of certain springs, such as the Matlock springs. Rain water contains carbonic acid, which is capable of dissolving carbonate of lime, and holding it in solution as bicarbonate of lime. In limestone districts rain water percolating through the rocks takes up a certain quantity of calcium carbonate; and if the water is then discharged and allowed to evaporate, or lose some of its carbonic acid, some of the calcium bicarbonate changes back to the insoluble carbonate, and is deposited.

If the water drips slowly from the roof of a cave, a hanging column of calcium carbonate, or *stalactite*, results. As the water drips to the floor it gives up more of its calcium carbonate, which gradually grows up from the floor as a *stalagmite*.

The Siliceous Rocks include the arenaceous rocks already described, but we have in addition some siliceous rocks which are formed through organic agency, and some through chemical agency.

Tripoli is composed of the siliceous tests of minute diatomaceæ, so small that there are about 40,000 millions of them in a cubic inch of the material.

Radiolarian ooze and *radiolarian earth* are composed of the siliceous skeletons of minute radiolarians.

Flint is a compact form of impure silica, and is found chiefly in the upper chalk. In many cases, at all events, it appears to have been formed by the deposition from sea water of silica around sponges, shells, etc. *Chert* is a very impure variety of

flint. *Sinter* is a siliceous deposit formed around certain geysers and hot springs by the deposition of dissolved silica as the water cools.

The Carbonaceous Rocks.—*Peat* consists of the partly-changed remains of vegetable matter, and is of modern origin. *Lignite* is a brown coal consisting chiefly of partly mineralised wood, in which the vegetable structure is still apparent. It is mostly of comparatively recent geological formation.

Coal is a black rock consisting of mineralised vegetable matter. It often shows a fibrous structure, and breaks in prismatic blocks. *Spore coal*, such as occurs in Yorkshire and Leicestershire, consists almost entirely of the spores and macrospores of cryptogams. *Anthracite* is a variety of coal in which nearly everything except carbon has disappeared.

Graphite is probably due to a more complete change brought about in vegetable remains by means of heat and pressure, and consists of almost pure carbon in a crystalline form.

The denser varieties of coal have probably been formed from wood and vegetable remains by the agency of heat and pressure. These have caused hydrogen, oxygen, and nitrogen to escape, either free or in chemical combination. Carburetted hydrogen and carbon dioxide have also been driven out, but the percentage of carbon in the residue has gradually increased as the action has been continued.

CHEMISTRY.

(ADVANCED AND HONOURS.)

BY C. A. WEST, B.SC., A.R.C.S., F.I.C.

Estimation of Sulphur by Hydrogen Peroxide (Julius Petersen, *Zeit. Anal. Chem.*, 1903, p. 42).—In this paper a useful method of estimating sulphur in some organic compounds is given. The sulphur in many compounds can be oxidised to sulphuric acid by hydrogen peroxide in alkaline solution. Substances insoluble in water, but soluble in alcohol, can also be treated by this method, for the reaction takes place equally well in alkaline alcoholic solution. The method can be usefully applied for estimating sulphur in gunpowder. The powder is first boiled with sodium hydrate, and the solution treated while warm with hydrogen peroxide. It is then boiled, acidified, filtered and evaporated to expel nitric acid, dissolved, and finally precipitated with barium chloride. Some organic substances, however, such as thiophen, ethyl sulphide, phenyl mercaptan, and ethyl thiocyanate, yield no sulphuric acid, however, when treated with alkaline hydrogen peroxide.

Apparatus for the Purification of Gases (Henri Moissan, *Compt. rend.*, 1903, p. 137).—Gases may be desiccated by passing them through tubes immersed in refrigerating liquids. In this way moist air, after passing through tubes cooled to -50° C., can be dried to such an extent that on afterwards passing several litres of it through drying tubes no increase in the weight of the tubes can be detected.

In the preparation of readily liquefiable gases it is not necessary to free the generating flask, tubes, etc., from air before collecting the gases, as these can be solidified by passage through cooled vacuum tubes.

The apparatus employed in the preparation of pure dry gases on these principles consists of the usual generating apparatus connected to a series of three desiccating tubes immersed in suitable volatile liquids boiling between -200° and -30°, a three-way tap communicating with (*a*) a mercury manometer, and (*b*) a condensing vessel of special form which is connected to a mercury pump. The gas produced is liquefied, and finally solidified in the condensing tube; communication with the generating apparatus is then stopped, and the remainder of the apparatus exhausted; finally the condenser is allowed to rise in temperature, and the gas collected in the usual way, fractionation being employed if necessary.

The method has been successfully employed in the preparation of carbon dioxide, hydrogen iodide and chloride, nitric oxide, etc.

Estimation of Ammonia (Alexander Bayer, *Chem. Zeit.*, 1903, p. 27) gives a method of estimating ammonia in the case of liquid containing, in addition to ammonium salts, other nitrogenous compounds likely to yield ammonium on distillation. The process is as follows:—200 c.c. of the liquid are mixed with a little concentrated hydrochloric acid, two drops of phenol phthalein are added, and then an excess of magnesium chloride. About twelve grams of disodium phosphate are now added, and the liquid stirred, while sodium hydrate solution is added until a permanent red colour is produced. After fifteen minutes the precipitate, containing the magnesium ammonium phosphate, is collected at the pump, and the well-drained mass distilled in the usual way with alkali to set free the ammonia.

Do the Ions carry the Solvent with them in Electrolysis?—C. A. Lobry de Bruyn has electrolysed a solution of silver nitrate in a mixture of methyl alcohol and water between silver electrodes, with a view to answering this question. After the electrolysis the solutions at the anode and cathode were analysed. No change in the concentration of the methyl alcohol could be detected. The result indicates, therefore, that there is no migration of the solvent molecules with the electrolytic ions, although it is possible that the two ions act in a similar way, and carry equal quantities of one or both of the solvents, but in opposite directions.

Separation and Estimation of Silver Cyanide and Silver Chloride.—Mr. R. H. A. Plimmer, in a paper read before the Chemical Society, gives the following method of estimating silver chloride and cyanide in presence of each other. Freshly precipitated silver cyanide, although insoluble in cold dilute nitric acid, readily dissolves in the boiling acid, evolving the theoretical quantity of hydrocyanic acid, so that the gas, when passed into silver nitrate solution, produces an amount of silver cyanide equal in weight to the original sample employed. In this way silver cyanide may be quantitatively separated from silver chloride. When the cyanide has been dried at 100°, the hard lumps produced offer a greater resistance to the solvent, and if the boiling is prolonged, the acid, on becoming more concentrated, oxidises a small proportion of the hydrocyanic acid.

Estimation of Manganese as Sulphide.—Under certain conditions of temperature and dilution manganese may be precipitated as a flesh-coloured hydrated sulphide, or as a dense green anhydrous sulphide. As is well-known in the case of the flesh-coloured precipitate, filtration is difficult, and, moreover, the precipitation is often incomplete.

In the case of the green sulphide, the precipitate adheres obstinately to the filter paper. If, however, the precipitation is carried out below the boiling-point, and the hydrated precipitate converted into the anhydrous sulphide by heating with ammonia in excess, filling the filter once with alcohol after the precipitate has been well washed with ammonium sulphide, it is found after drying that the precipitate can easily be detached from the paper, and usually shows a constant weight after one ignition.

Influence of Salts on the Solubility in Water of Hydrogen Sulphide, Iodine, and Bromine (William H. M'Lauchlan, *Zeit. Physikal Chem.*, 1903, p. 44).—The vapour pressure of hydrogen sulphide in a number of salt solutions was determined, and the solubility in these and other solutions determined by analysis. The agreement between the two sets of results proves the validity of Henry's law in these cases. The solubility of iodine and bromine in these salt solutions was also determined, in order to discover how far the solubility was affected by probable chemical action between the two dissolved substances. The only solutions in which bromine was less soluble than in water were those of the nitrates and sulphates of potassium and sodium; the solubility of iodine was diminished not only in these but also in ammonium sulphate. The increased solubility of iodine and bromine in solutions of potassium and sodium chlorides is doubtless due to the formation of complex bodies. It is further to be noted that ammonium salts in general raise the solubility both of bromine and iodine, a result for which probably the hydrolysis of the ammonium salt is responsible.

The Formation of Ozone (Eugen Goldstein, Berlin, 1903, p. 36).—A tube of fused quartz was exhausted until the pressure was only a few mm., and then charged from an induction coil. An intense odour of ozone was apparent in the surrounding air, and iodised starch paper was quickly turned blue. The odour of the ozone was not perceptible when the pressure inside the tube exceeded a certain value; it was faint at very small pressures, and was most intense when the light from the discharge was brightest. The phenomenon is probably due to the ultra-violet light rays of small wave-length penetrating the tube, and then converting the oxygen of the air into ozone.

A Geissler tube was exhausted, and oxygen was passed into it until the pressure was several cm. The tube was then partially immersed in liquid air, and charged from an induction coil. After half a minute the tube became luminous, and the pressure sank to about 0·1 mm. Oxygen was again introduced until the pressure was several cm., and the sparking continued. By repeated treatment in this way oxygen may be completely converted into ozone, which forms as a dark blue liquid. The liquid ozone obtained was not found to be spontaneously explosive.

Molecular Weights of Metallic Chlorides.—The molecular weights of some metallic chlorides have been recently deter-

mined from the boiling-points of their solutions in bismuth chloride, which boils at 447°, and has a normal vapour density at 490°. The method adopted was to determine the influence of pressure on the boiling-point of the solvent, and to calculate the vapour pressure of the solution from the elevation of the boiling-point. The molecular weight was then calculated directly from the vapour pressure, and the use of the boiling-point constant was thus avoided. The following results were obtained :—

	M. W. (*found*)	*M. W.* (*calculated*)
$NaCl$	64·2	58·5
$BaCl_2$	209·4	208·3
$SrCl_2$	163·9	158·5
$MnCl_2$	129·8	125·9
$CoCl_2$	127·6	129·9
$CuCl_2$	127·2	134·5.

Phosphomolybdic Acid.—M. G. Levi and E. Spelta have prepared several carefully purified samples of phosphomolybdic acid, and analysed these. Their results confirm the formula given to this substance by Finkener and Gibbs—namely, H_3PO_4, $12MoO_3$, $29H_2O$.

They have also made melting-point, boiling-point, and conductivity measurements of solutions of the acid, and have studied its behaviour towards bases and indicators, its conductivity during neutralisation, and its influence on the catalysis of methyl acetate. The results show that the combination between the phosphoric and molybdic acids is a very unstable one, and is destroyed by alkalis, and to some extent by water alone. By titrating with sodium hydroxide solution in presence of litmus, phenol phthalein, or rosolic acid, it is found that a molecule of the acid contains twenty-seven replaceable hydrogen atoms—the number required on the supposition that the acid is resolved into phosphoric and molybdic acids. The occurrence of such resolution in alkaline solution is confirmed by the fact that phosphoric acid may be quantitatively precipitated in ammoniacal solution, even in presence of molybdenum. Further, with ammonia, solutions of phosphomolybdic acid give first a precipitate of phosphomolybdate which dissolves in the slightest excess of ammonia, while phosphoric acid can only be precipitated by ammonium molybdate in strongly acid solutions, and the precipitate formed is soluble in ammonia. Hence ammonia resolves the ammonium phosphomolybdate into ammonium phosphate and molybdate.

Estimation of Formic Acid.—M. Wegner bases a method of estimating formic acid on the fact that formic acid is broken up by hot strong sulphuric acid into water and carbon monoxide. The air is first expelled from the flask in which the decomposition is to take place, by means of a stream of carbon dioxide. The formate and sulphuric acid are heated together, and the evolved gases passed through a second flask containing sulphuric acid, heated to 180° to decompose any formic acid which may distil over undecomposed in the first case. In carrying out the estimation the formate (0·1 gram in 2 c.c. of solution) having been introduced into the first flask, 25–30 c.c. of concentrated sulphuric acid are slowly admitted from a dropping funnel, and when the evolution of gas ceases this mixture is also heated to 180°. The carbon monoxide is finally driven over by carbon dioxide into a measuring tube containing potassium hydroxide solution.

THEORETICAL MECHANICS.

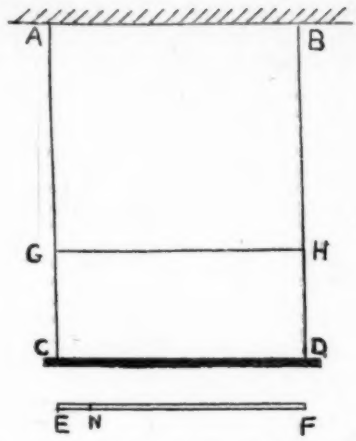
(ADVANCED AND HONOURS STAGES.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mechanics, etc., Morley College, London; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

Tension of a Surface.—The simplest case of the tension of a surface is that of a sheet of some thin material of uniform thickness, suspended from a fixed support. A good illustration is furnished by an ordinary wall-map, ABCD, fixed along its upper edge AB, and supporting a comparatively heavy load, such as a roller, CD, fastened to the lower edge of the map. A section along any line such as GH will consist of a thin rectangle EF. Denoting the length EF by l, and the width or breadth of the rectangle by b, then the area of such a rectangle will be bl units of area. The intensity of the stress or *amount of force per unit of area* is obtained from the relation, *load ÷ area*. $\therefore s = W \div bl$, where s denotes the stress and W the weight of the roller.

It is convenient to be able to refer to the stress across a line such as GH. Hence, if from E a length EN is made equal to



the unit of length, then the area of the small rectangle so formed is $1 \times b$ or b units of area. The stress on this area may in the usual manner be denoted by t; then t is the tension of the sheet per unit length across the line GH.

$$\therefore t = \frac{W}{l} = bs.$$

The preceding is of importance not only in the case of a film, but also in that of a vessel made of thin material and containing fluid. The tension produced in the material is measured in the same manner as the tension of a plane sheet.

Stress and Strain.—The meaning of the word stress, as already indicated, is the ratio $\frac{W}{A}$, where W denotes the load to which a bar or rod is subjected, and A the area of cross section.

Strain denotes the alteration in form or figure produced by stress. Thus a stress of the nature of a tension tending to pull it asunder will be produced when a rod or bar of any material is fixed or suspended at one end and made to carry a load at the other. The stress produced is obtained by dividing the number indicating the weight or load on the rod by the area of cross section, and the *strain* is the fractional alteration in the length, or elongation per unit length. All materials are more or less elastic; for each kind of material experiment shows that stress is proportional to strain—that is, if a load of 100 lbs. stretches a rod through a distance 0·01 inch, then 200 lbs. will cause it to stretch a distance 0·02 inch, etc. The relation just referred to is known as *Hooke's Law*, and may be expressed as

$$\text{stress} = E \times \text{strain}, \text{ or } \frac{\text{stress}}{\text{strain}} = E.$$

E is a constant called the *modulus of elasticity*. It is also known as *Young's Modulus*. The numerical values of E for various materials are tabulated, or can be obtained by experiment.

Ex. 1. A rod 15 feet long, with a uniform section of six square inches, is hung up by one end, and carries a weight of 30 tons at the other; it is thereby stretched a quarter of an inch. Find the value of the stress, strain, and modulus of elasticity.

$$\text{Stress} = \frac{\text{load}}{\text{area}} = \frac{30 \times 2240}{6} = 11200 \text{ lbs. per sq. in.}$$

$$\text{Strain} = \frac{\text{alteration in length}}{\text{original length}} = \frac{\frac{1}{4}}{12 \times 15} = \frac{1}{720}.$$

$$\text{Modulus of elasticity} = \frac{\text{stress}}{\text{strain}} = \frac{11200}{\frac{1}{720}} = 8064000 \text{ lbs. per sq. in.}$$

Tensile Strength.—If, as in the preceding case, a rod of any material be suspended from one end, and weights hung at the other, it is found for each kind of material that there is a certain stress which is sufficient to fracture the rod. The magnitude of this stress is called the *tensile strength* or *tenacity* of the material. Thus the statement that the tenacity of a certain kind of material is 12,000 lbs. per sq. inch simply implies that a bar of the material one square inch in section will be pulled asunder by a tension greater than 12,000 lbs.

Ex. 2. Determine the mechanical advantage of a smooth screw. Prove that a force of 14 lbs. at the end of a lever 3 feet long to tighten the nut on a screw bolt 1 inch diameter with 8

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threads per inch will be sufficient to break the bolt if the breaking tension of the material is less than 14·4 tons per sq. inch. (Inter. 1901.)

If P denotes the effort or force applied to a smooth screw, and W the load or weight raised, then when P moves through a distance $2\pi \times 36$ inches, the load will be raised through a distance equal to $\frac{1}{8}$ inch. Hence by the principle of work we obtain

$$P \times 2\pi \times 36 = W \times \tfrac{1}{8}.$$

$$\therefore 14 \times 2\pi \times 36 = W \times \tfrac{1}{8}.$$

$$\text{Or, } W = 14 \times 2\pi \times 36 \times 8.$$

From the relation load = stress × area we obtain

$$14 \times 2\pi \times 36 \times 8 = \text{stress} \times 1^2 \times \frac{\pi}{4}.$$

$$\therefore \text{stress} = \frac{14 \times 2\pi \times 36 \times 8}{\cdot 7854 \times 2240} = 14{\cdot}4 \text{ tons per sq. in.}$$

Tension of a Sphere under Internal Pressure.—The consideration of the tension in the surface produced by the pressure of the enclosed fluid is of the utmost importance. The formula obtained not only applies to the case where metal of some kind is the material used, but is also applicable to the surface tension of a soap-bubble.

Let p denote the internal pressure in a sphere of internal radius r. Imagine a plane section passing through the centre of the sphere. Such a diametral plane would be a great circle of the sphere, and the magnitude of the resultant pressure will be $p \times \pi r^2$. Along the circumference of such a circle there will be tensions perpendicular to the plane of the circle. The resultant of all the tensions will be $t \times$ (circumference of circle) $= 2\pi rt$, where t denotes the tension per unit length.

Hence we have $2\pi rt = \pi r^2 p$.

$$\therefore t = \tfrac{1}{2}pr. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

If T denote the thickness, and S the tensile strength of the material, then the greatest tension at the surface which can be furnished by the material is TS.

$$\text{Hence } p = \frac{2TS}{r}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Ex. 3. A bar of metal whose cross-section is one square inch is suspended by one end, and can just support a weight of 12,000 lbs. hanging from the other end. A hollow sphere whose radius is one foot, and thickness $\frac{1}{4}$ inch, is made of the metal. Find the internal pressure that will just burst it. (1895.)

Here the tensile strength of the material is 12,000 lbs. per sq. inch. If p denote the bursting pressure, then from (2)

$$p = \frac{2 \times 12000 \times \frac{1}{4}}{12} = 400 \text{ lbs. per sq. in.}$$

Ex. 4. Investigate the tension of a sphere made of thin flexible material, under internal fluid pressure.

Prove that to separate the Magdeburg hemispheres (2 ft. in diameter), when half exhausted of air, would require a force of about 3,400 lbs. (1903.)

From (1), $t = \frac{1}{2} \times 15 \times 12 = 90$ lbs.

From (1), taking the atmospheric pressure to be 15 lbs. per sq. inch, we obtain

$$t = \tfrac{1}{2} \times \tfrac{15}{2} \times 12 = 45 \text{ lbs.}$$

Let P denote the force required. Then

$$P = 2\pi \times 12 \times 45 = 3395 \text{ lbs.}$$

Soap-Bubble.—In a soap-bubble the surface tension of the film tending to make the bubble contract is balanced by the excess of the internal over the external pressure. As the thickness of the film is very small, r may be taken to denote the external and the internal radius. A diametral plane will cut the sphere in a great circle; its area will be πr^2, and the magnitude of the resultant force will be $p \times \pi r^2$. If t denotes the tension per unit length along the circumference of the great circle, then the surface tension on the outside of the film will be $t \times 2\pi r$; and there is a similar amount from the inside surface.

$\therefore$ total force will be $2t \times 2\pi r = 4\pi tr$.

Hence $p \times \pi r^2 = 4\pi tr$.

$$\therefore p = \frac{4t}{r}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Tension of a Cylinder under Internal Pressure.—Let r denote the radius of the cylinder, and l its length. A diametral plane will form a rectangle of length l and thickness $2r$. The resultant force on such a plane will be $p \times 2rl$.

The diametral plane will cut the cylinder in two generating lines, the tension along each being $t \times l$. Hence

$$p \times 2rl = 2tl. \quad \therefore t = pr.$$

As before, if T denote the thickness of the material, and S the tensile strength or tenacity of the material, then $pr = TS$.

$$\therefore p = \frac{TS}{r}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Ex. 5. Find the tension of a thin cylinder under internal fluid pressure. If the internal diameter of a tube is 8 inches, the thickness of the material 0·1 inch, and its tenacity 20,000 lbs. per sq. inch, find the bursting pressure. (1893.)

From (4) we obtain

$$p = \frac{0{\cdot}1 \times 20000}{4} = 500 \text{ lbs. per sq. in.}$$

Ex. 6. Two tubes are made of material of the same thickness, but the tenacity of the one is half that of the other. If the diameter of the former tube is three-eighths of the diameter of the latter, compare the pressures per sq. inch that would burst them. (1899.)

Eq. (4) may be written, $p = \frac{2TS}{d}$.

Let p_1, T_1, S_1, and d_1 denote the pressure, thickness, tensile strength, and diameter respectively of the second cylinder. Then

$$\frac{p}{p_1} = \frac{2S}{d} \div \frac{2S_1}{d_1} = \frac{Sd_1}{S_1 d}.$$

Substituting the given values, we obtain

$$\frac{p}{p_1} = \frac{\frac{1}{2}S_1 \times d_1}{S_1 \times \frac{1}{2}d_1} = \frac{1}{1}.$$

Ex. 7. Find the tension at any point of a thin flexible spherical envelope. Let the sphere have a radius of 30 feet, and let the pressure at any point be 0·75 lbs. per sq. inch. Compare the tension at any point with that of a ribbon a quarter of an inch wide that carries a weight of 25 lbs. Ans. 1·35 : 1.

Ex. 8. Show that the work done in expanding a soap-bubble from radius a to radius b is equal to $4\pi(b^2 - a^2)t$.

Why is t, the tension of the film, constant?

Find the result in foot pounds when the diameter of the bubble is increased from 3 to 12 inches, having given that the surface tension is 1·12 grains weight per inch. (1896.)

Ans. 0·00056 ft. pds.

Ex. 9. In a plane film show that the superficial energy per unit of area is numerically equal to the tension per unit of length. Find the superficial energy in foot poundals per sq. foot when the surface tension equals the weight of 1·75 grains per inch. (1897.)

Ex. 10. Prove that if a man who can apply a force of 28 lbs. is provided with a lever 3 feet long to tighten up bolts 1 inch diameter, he will be apt to break the bolts if the number of threads exceed 8 per inch, breaking tension 30 tons per sq. inch. (Inter. 1900.)

Co-ordination of Schools.—Professor Michael Sadler presided at the Education Conference at Leeds, when one of the most interesting matters discussed was the "Co-ordination of Schools." The president said the matter was of signal difficulty and pressing practical importance. By fairly general consent the project of educational engineering needed to be contrived so as to furnish alternative courses of study fitted to different types of intellectual taste and of practical aptitude. The intellectual needs were too diverse for any kind of educational monopoly. Thrifty use should be made of existing materials, and as much as possible of what was of tested excellence in the older educational tradition should be preserved. The project should steadily aim, not at multiplying recruits for the more literary callings, but at fitting every boy and girl according to their aptitude for the responsibilities of modern citizenship and for the practical tasks of life. He held the belief that the co-ordination of our English primary and secondary schools, though largely a question of practical organisation, was not to be brought about by mechanical change alone. For what was at present amiss the best remedy would come through the spirit of mutual good-will—through the attitude of mind which thought of national education as the one thing interrelated in all its parts.

"Commercial education" also engaged attention. Professor Clapham of the Yorkshire College pointed out the danger of laying too much stress on those subjects which were obviously commercial, and remarked that modern languages were an essential part of any tolerable commercial education. He suggested that their energies would be better spent in improving existing machinery than in devising elaborate systems for doing work done in the past by institutions already in the field.

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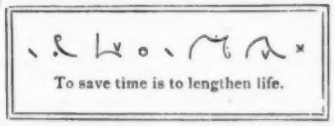

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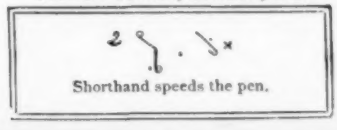

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Rhystyd.—Prove that, if the graduations of a spring balance are uniform, a weight suspended will perform vertical oscillations which are simple harmonic. Determine the length of the equivalent simple pendulum.

A suspended weight will perform simple harmonic vertical oscillations when the force F, acting on the body, is given by $$F = cmxn^2, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$ where c is a constant $= 4\pi^2$, n is the number of complete oscillations per second, m the mass, and x the displacement of the body at any instant from the equilibrium position.

Eq. (1) may be written $\frac{F}{x} = 4\pi^2 n^2 m$.

Hence, when x is doubled, F is doubled—that is, F is directly proportional to x, or, in other words, the graduations of the scale or spring balance are uniform.

The time of a vibration is given by

$$T = 2\pi \sqrt{\frac{\text{displacement}}{\text{acceleration}}},$$

where T denotes the periodic time.

It may be desirable to explain this at somewhat greater length. Thus, if l denotes the extension in feet produced by a load of W lbs., then we may assume that a force of F lbs. is applied, say, by the hand to the weight, so as to pull it an additional distance of x feet from the position of equilibrium, and to hold it there. At the instant that the force from the hand ceases to act there is a resultant upward force equal to $\frac{x}{l}$W. Then, from the relation force = mass × acceleration, we obtain

$$\frac{x}{l} W = \frac{W}{g} \times \text{acceleration}.$$

$$\therefore \text{acceleration} = \frac{gx}{l},$$

$$\text{or, } \frac{\text{displacement}}{\text{acceleration}} = \frac{l}{g}.$$

$$\text{Hence } T = 2\pi \sqrt{\frac{l}{g}}. \quad . \quad . \quad . \quad . \quad . \quad (2)$$

The length l of the equivalent simple pendulum is obtained from (2).

The preceding results are readily obtained by using the simple notation of the calculus. Thus, with the same symbols as before, we have

$$m \frac{d^2x}{dt^2} = -c(l + x) - W = -cx.$$

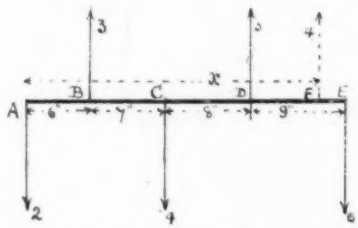
$$\therefore \frac{d^2x}{dt^2} + \frac{cx}{m} = 0. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

The solution to (3) is given by $T = 2\pi \sqrt{\frac{m}{c}}$.

Also $cl = mg$. $\therefore c = \frac{mg}{l}$.

Substituting, $T = 2\pi \sqrt{\frac{l}{g}}$.

Equilibrium.—Parallel forces of 2, 4, 6 units act in the same direction at points A, C, E respectively, in a straight line A, B, C, D, E, and parallel forces of 3 and 5 units act in the opposite direction at points B and D of the same straight line. AB = 6 inches, BC = 7 inches, CD = 8 inches, and DE = 9 inches. Find the magnitude, direction, and position of the resultant.



Let F be the point at which the resultant acts, and let the distance of F from A be x inches. As the sum of the downward forces is equal to 12, the magnitude of the resultant is 12 − 8 = 4 units. Its line of action (as the remaining parallel forces have been assumed to act in a vertical direction) is in a vertical direction.

To find the position of the resultant, we may take moments about any convenient point, such as A; and as already indicated, denoting the distance of the resultant from A by x, we obtain

$$3 \times 6 + 4x + 5 \times 21 = 4 \times 13 + 6 \times 30.$$

$$\therefore 4x = 109, \text{ or } x = 27\tfrac{1}{4}.$$

Hence the resultant acts at a point $27\frac{1}{4}$ inches from A.

Certif.—X and Y have a walking match. X takes 9 steps to Y's 8, and 89 of X's steps are equal to 90 of Y's. By how many yards would the winner beat the loser if the latter walks 1027 yards?

Since X takes more steps than Y in a given time, and X's steps are the longer, it is plain that Y will be loser.

Let a denote the length of X's step in yards. Then $\frac{8}{9}a$ denotes the length of Y's step in yards. But Y walks 1027 yards. Therefore Y takes $\frac{1027}{\frac{8}{9}a}$ steps. But X takes $\frac{8}{9}$ times as many steps as Y. Therefore X takes $\frac{9}{8} \cdot \frac{1027}{\frac{8}{9}a}$ steps. But the length of X's step is a yards. Hence X walks $\frac{9}{8} \cdot \frac{1027}{\frac{8}{9}a} \cdot a$ yards—that is, $\frac{1027 \times 9 \times 90}{8 \times 89}$ yards, that is, 1168·36 yards nearly.

Hence the winner beats the loser by (1168·36 − 1027) yards nearly—that is, by 141·36 yards nearly.

Puzzled.—The result quoted by you cannot be correct. If correct, it should hold for all values of α and β. You will find, however, on trial, that it does not hold when, for example, $\tan \alpha = \frac{1}{2}$ and $\tan \beta = \frac{1}{3}$.

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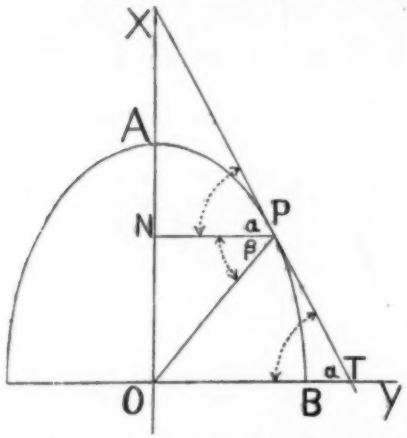
A. B. T.—The axis-major of an ellipse is vertical. Show that, in order that a particle projected vertically upwards from the extremity of the axis-minor along the concave side of the arc may pass through the centre after leaving the curve, the velocity of projection must be

$$\left\{\frac{(8a^2+b^2)g}{3a\sqrt{3}}\right\}^{\frac{1}{2}},$$

a and b being the semiaxes of the ellipse.

(Tait and Steele, *Dynamics of a Particle.*)



Let P be the point where the particle leaves the curve. Let α be the angle which PT, the tangent to the ellipse at P, makes with the axis-minor. Draw PN perpendicular to the axis-major, and join P and the centre O. If V denotes the velocity of projection, and v the velocity of the particle along the curve at the point P, then (x, y) being the co-ordinates of P, we have

$$V^2 = v^2 + 2gx. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

(See Tait and Steele, § 180.)

Now, in order that a particle projected from P with velocity v and elevation α may pass through O, we must have

$$PN = \frac{2v^2}{g\cos\beta}\cos\alpha\sin(\alpha+\beta),$$

where β denotes the angle NPO. (See Tait and Steele, § 112.)

$$\text{Hence } y = \frac{2v^2}{g\cos\beta}\cos\alpha(\sin\alpha\cos\beta+\cos\alpha\sin\beta).$$

$$\therefore v^2 = \frac{gy}{2(\sin\alpha\cos\alpha+\cos^2\alpha\tan\beta)}. \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Now, from the equation to the tangent to the ellipse at P, we see that $\tan\alpha = \frac{a^2y}{b^2x}$.

$$\text{Hence } \sin^2\alpha = \frac{a^4y^2}{a^4y^2+b^4x^2}, \text{ and } \cos^2\alpha = \frac{b^4x^2}{a^4y^2+b^4x^2}.$$

Again, $\tan\beta = \frac{x}{y}$; therefore equation (2) may be written

$$v^2 = \frac{y(a^4y^2+b^4x^2)}{2\left(a^2b^2xy+b^4x^2\cdot\frac{x}{y}\right)}\cdot g;$$

$$\text{that is, } v^2 = \frac{y^2(a^4y^2+b^4x^2)}{2b^2x(a^2y^2+b^2x^2)}\cdot g.$$

But from the equation of the curve $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, we have

$$a^2y^2+b^2x^2 = a^2b^2.$$

$$\text{Therefore } v^2 = \frac{(a^4y^2+b^4x^2)y^2}{2a^2b^4x}\cdot g. \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Hence equation (1) may be written

$$V^2 = \left\{\frac{(a^4y^2+b^4x^2)y^2}{2a^2b^4x}+2x\right\}\cdot g;$$

$$\text{that is, } V^2 = \frac{a^4y^4+b^4x^2y^2+4a^2b^4x^2}{2a^2b^4x}\cdot g. \quad . \quad . \quad . \quad (4)$$

Again, since the particle leaves the curve at P, we must have $\frac{v^2}{\rho} = g\cos\alpha$, where ρ is the radius of curvature at P. (See Tait and Steele, § 180.)

Now, in the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, the radius of curvature at any point (x, y) is given by

$$\rho = \frac{(a^2\sin^2\phi+b^2\cos^2\phi)^{\frac{3}{2}}}{ab},$$

where $x = a\cos\phi$ and $y = b\sin\phi$. (See Williamson's *Differential Calculus*, § 227.)

$$\text{Hence } \rho = \frac{(a^4y^2+b^4x^2)^{\frac{3}{2}}}{a^4b^4}.$$

$$\therefore v^2 = \frac{(a^4y^2+b^4x^2)^{\frac{3}{2}}}{a^4b^4}\cdot\frac{b^2x}{(a^4y^2+b^4x^2)^{\frac{1}{2}}}\cdot g;$$

$$\text{that is, } v^2 = \frac{a^4y^2+b^4x^2}{a^4b^2}\cdot x\cdot g. \quad . \quad . \quad . \quad . \quad . \quad (5)$$

But in equation (3) we have shown that

$$v^2 = \frac{a^4y^2+b^4x^2}{2a^2b^4x}\cdot y^2\cdot g.$$

Hence, from equations (3) and (5), we have

$$y^2 = \frac{2b^2}{a^2}\cdot x^2. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

But from $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, the equation of the curve, we have

$$y^2 = \frac{b^2}{a^2}(a^2-x^2). \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

Therefore from (6) and (7) we have

$$x^2 = \frac{a^2}{3},\ y^2 = \frac{2b^2}{3}.$$

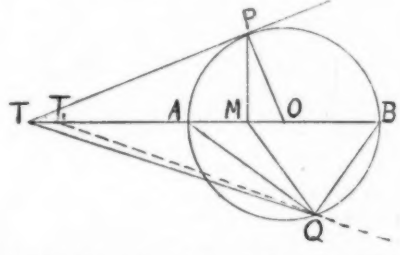
Substituting these values of x and y in equation (4), we have

$$\therefore V^2 = \frac{\frac{1}{3}a^4b^4+\frac{2}{3}a^2b^6+\frac{1}{3}a^4b^4}{2a^2b^4\cdot\frac{a}{\sqrt{3}}}\cdot g.$$

$$\therefore V^2 = \frac{\frac{2}{3}a^2+\frac{1}{3}b^2+2a^2}{a\sqrt{3}}\cdot g.$$

$$\therefore V = \left\{\frac{(8a^2+b^2)\cdot g}{3a\sqrt{3}}\right\}^{\frac{1}{2}}.$$

Carvett.—A tangent TP is drawn to a circle from an external point T, and PM is drawn perpendicular to the line which joins T to the centre of the circle. If Q be any point on the circumference of the circle, prove that TQ is to QM in the ratio of TP to PM.



Let O be the centre of the circle, and let TO meet the circumference in AB. Draw PM perpendicular to AO, and join PO. Take Q any point on the circumference of the circle, and join TQ, AQ, MQ. Make the angle AQT_1 equal to the angle AQM. Because the triangle TPO is right-angled at P, and PM is drawn perpendicular to TO, therefore $TM\cdot MO = MP^2$.

$$\text{Hence } TM\cdot MO + MO^2 = MP^2 + MO^2.$$

$$\therefore TO\cdot OM = OP^2 = AO^2.$$

$$\therefore (TA+AO)\cdot OM = AO^2.$$

$$\therefore TA\cdot OM = AO(AO-OM).$$

$$\therefore TA\cdot OM = AO\cdot AM.$$

$$\therefore \frac{TA}{AM} = \frac{AO}{OM} = \frac{OB}{OM}.$$

$$\therefore \frac{TA}{AM} = \frac{TA+AO+OB}{AM+MO+OM}$$

$$= \frac{TB}{AO+OM} = \frac{TB}{BO+OM} = \frac{TB}{BM}.$$

$$\text{Hence } \frac{TB}{TA} = \frac{BM}{MA}.$$

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Again, because $\angle T_1QA$ is equal to $\angle AQM$, and $\angle AQB$ is a right angle, therefore QB bisects the external angle between T_1Q and QA.

Hence $\frac{T_1B}{BM} = \frac{T_1A}{AM}$, and $\therefore \frac{T_1B}{T_1A} = \frac{BM}{MA}$.

But $\frac{BM}{MA} = \frac{TB}{TA}$; $\therefore \frac{T_1B}{T_1A} = \frac{TB}{TA}$.

Hence T_1 coincides with T, and therefore the angle TQA is equal to the angle AQM.

$$\therefore \frac{TQ}{QM} = \frac{TA}{AM}.$$

But Q is *any* point on the circumference of the circle.

$$\therefore \frac{TP}{PM} = \frac{TA}{AM}. \quad \text{Hence } \frac{TQ}{QM} = \frac{TP}{PM}. \quad Q.E.D.$$

X.—If the sum or difference of the tangents from a variable point to two circles be equal to the part of the common tangent of the two circles between the points of contact, the locus of the point is a right line.

It is obvious that any point on the part of the common tangent between the points of contact satisfies the first of the given conditions, and that any other point on the common tangent satisfies the second.

That no point *except* a point on a common tangent satisfies the given conditions may be proved in the following way:—

Taking the centre of one of the circles as origin and the right line joining the centres of the two circles as axis of x, then the equations of the circles referred to rectangular co-ordinates are

$$x^2 + y^2 = r^2$$

and $$(x - a)^2 + y^2 = \rho^2,$$

r being the radius of the circle whose centre is at the origin, ρ the radius of the other circle, and a the distance between the centres.

Now, taking x, y as the co-ordinates of any point which satisfies the conditions of the question, the length of the tangent from x, y to the first circle is $\sqrt{x^2 + y^2 - r^2}$, and the length of the tangent from the same point to the other circle is $\sqrt{(x - a)^2 + y^2 - \rho^2}$. Also the length of the common tangent to the two circles is $\sqrt{a^2 - (r - \rho)^2}$. Hence we must have $\sqrt{(x - a)^2 + y^2 - \rho^2} \pm \sqrt{x^2 + y - r^2} = \sqrt{a^2 - (r - \rho)^2}$.

Rationalising we have

$$\{x^2 + y^2 - ax - r\rho\}^2 = (x^2 - 2ax + y^2 + a^2 - \rho^2)(x^2 + y^2 - r^2);$$

and hence, on expanding and collecting terms, we have

$$\{a^2 - (r - \rho)^2\}y^2 - \{(r - \rho)x - ar\}^2 = 0.$$

Since this equation can be written in the form

$$[\{a^2 - (r - \rho)^2\}^{\frac{1}{2}}y + \{(r - \rho)x - ar\}]$$

$$\times [\{a^2 - (r - \rho)^2\}^{\frac{1}{2}}y - \{(r - \rho)x - ar\}] = 0,$$

it represents a pair of straight lines—namely,

$$\{a^2 - (r - \rho)^2\}^{\frac{1}{2}}y + \{(r - \rho)x - ar\} = 0 \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and $$\{a^2 - (r - \rho)^2\}^{\frac{1}{2}}y - \{(r - \rho)x - ar\} = 0 \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Now the length of the perpendicular from any point (x_1, y_1) on (1) is

$$\frac{\{a^2 - (r - \rho)^2\}^{\frac{1}{2}}}{\{a^2 - (r - \rho)^2 + (r - \rho)^2\}^{\frac{1}{2}}}y_1 + \frac{r - \rho}{\{a^2 - (r - \rho)^2 + (r - \rho)^2\}^{\frac{1}{2}}}x_1 - \frac{ar}{\{a^2 - (r - \rho)^2 + (r - \rho)^2\}^{\frac{1}{2}}};$$

that is, $$\frac{\{a^2 - (r - \rho)^2\}^{\frac{1}{2}}}{\pm a}y_1 + \frac{r - \rho}{\pm a}x_1 - \frac{ar}{\pm a} \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Now putting the co-ordinates (0, 0) of the centre of the first circle for (x_1, y_1) in (3), we see that the length of the perpendicular from the centre of the first circle to the line (1) reduces to $\frac{-ar}{\pm a}$, or r; that is, the perpendicular from the centre is equal to the radius. Hence (1) is a tangent to the first circle.

Similarly, on writing $(a, 0)$, the co-ordinates of the second circle, for (x_1, y_1) in (3), the expression reduces to ρ. Hence (1) is also a tangent to the second circle. Therefore (1) is a common tangent to the two circles.

Similarly (2) may be proved to be a common tangent to the two circles.

Hence any point which satisfies the conditions of the question must lie on a common tangent.

Kindly refer to Rule 1.

Pater.—Solve the equation $27x^3 + 21x + 8 = 0$.

The given equation can be written in the form

$$(27x^3 + 1) + 7(3x + 1) = 0.$$

Now $(3x + 1)$ is obviously a factor of the left-hand side of the last equation. Hence the given equation can be written in the form

$$(3x + 1)\{(9x^2 - 3x + 1) + 7\} = 0,$$

or $$(3x + 1)(9x^2 - 3x + 8) = 0.$$

If $3x + 1 = 0$, we shall have

$$x = -\frac{1}{3}.$$

If $(9x^2 - 3x + 8) = 0$, we shall have

$$x = \frac{3 \pm \sqrt{9 - 9 \times 32}}{18},$$

or $$x = \frac{1 \pm \sqrt{-31}}{6}.$$

Hence the roots of the given equation are

$$-\frac{1}{3}, \frac{1 + \sqrt{-31}}{6}, \frac{1 - \sqrt{-31}}{6}.$$

S. and A.—If $y = \frac{(x - a)(x - b)}{(x - m)(x - n)}$, show that the condition that y should assume all real values as x assumes all real values is that *one* and only one of the two constants a and b is intermediate in magnitude between the two constants m and n.

(S. and A. Honours, 1903.)

Multiplying across, we have

$$y\{x^2 - (m + n)x + mn\} - \{x^2 - (a + b)x + ab\} = 0.$$

$$\therefore (y - 1)x^2 + \{(a + b) - (m + n)y\}x + mny - ab = 0.$$

Hence, if x be real, we must have

$$\{a + b - (m + n)y\}^2 - 4(y - 1)(mny - ab)$$

positive; that is,

$$(m - n)^2y^2 - 2\{(a + b)(m + n) - 2(ab + mn)\}y + (a - b)^2$$

must be positive for all values of y.

The condition that this should be the case is that

$$\{(m - n)(a - b)\}^2 - \{(a + b)(m + n) - 2(ab + mn)\}^2$$

should be positive—that is, that

$$\{am + bn - (ab + mn)\}\{(ab + mn) - (bm + an)\}$$

should be positive—that is, that $(ab + mn)$ should be intermediate in magnitude between $(am + bn)$ and $(bm + an)$.

The required condition is, therefore, that $(am + bn)$, $(ab + mn)$, $(bm + an)$ should be either in ascending or in descending order of magnitude.

Now, in the first case we must have

$$bm + an > ab + mn;$$

that is, $$a(n - b) > m(n - b);$$

that is, $$a > m.$$

We must also have

$$am + bn < ab + mn;$$

that is, $$a(m - b) < n(m - b);$$

that is, $$a < n.$$

Hence we must have a intermediate in magnitude between m and n.

Further, when

$$bm + an > am + bn,$$

and a is $< n$ but $> m$,

then $$bm + n^2 > m^2 + bn;$$

that is, $$b(m - n) > m^2 - n^2;$$

that is, $$b > m + n.$$

That is, when a is intermediate in magnitude between m and n, b is *not* intermediate in magnitude between m and n.

Similarly, in the second case, if $(am + bn)$, $(ab + mn)$, $(bm + an)$ are in descending order of magnitude, b is intermediate in magnitude between m and n, and then a is *not* intermediate in magnitude between m and n.

B.Sc.—The regulations for the B.Sc. Examination of London University may be obtained by writing to the principal. It is impossible to advise you as to text-books, etc., for chemistry without knowing something of your previous work in this subject. Do not attempt it without good opportunities for practical work, and take the advice of your teacher as to the books for his course.

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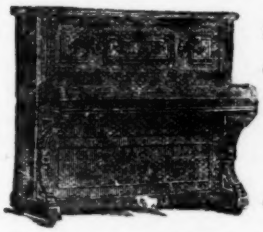

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THE EDITOR'S TABLE

AMERICAN BOOK COMPANY.

Physical Laboratory Manual for Secondary Schools. By S. E. Coleman. This volume contains a number of suitable elementary experiments in physics, including density and molecular phenomena, mechanics of fluids and solids, heat, sound, light, magnetism, and electricity. There can be no doubt that the best way in which a student can obtain clear notions of the subject is through the processes of measurement and verification, and the experiments indicated are very suitable for such a purpose. The arrangement is excellent. One of the best features is the constant insistence that accuracy and care should be exercised even in the process of carrying out an elementary experiment. When this is the case, the experimenter cannot fail to derive great benefit from his work. In an appendix a series of useful tables of coefficients of expansion, melting and boiling points, specific heats, etc., is given.

E. J. ARNOLD.

Chalk-Drawing: A Manual for Teachers. By Hannah Dean. "Drawing on simple lines from nature is most fittingly recognised as an essential subject in our primary schools." "Chalk-drawing provides for teachers a most agreeable and interesting subject, one well adapted for increasing and cultivating the child's powers of observation." "Encourage the children to observe closely."

The above are extracts from the preface of the book, and are in themselves valuable points. It is a pity the author did not carry these precepts into practice in the illustrations. We cannot think that the representations of the gooseberries, strawberries, radish, poppy, tulip, violet, snowdrop, crocus, sunflower, rose, bulrushes, water-lily, etc, were the result of "close observation" of natural forms, so many of them are entirely wrong both in growth and in arrangement.

GEORGE BELL AND SONS.

Arithmetic, Scheme B, Standard VI. By C. Pendlebury, M.A. The author's name led us to expect a right interpretation of Scheme B, whereas the very essence appears to be missed, and ability in mechanical operations remains as prominent in aim as in Scheme A, for which this book would seem suited did it fit the requirements.

Bell's Miniature Series of Musicians. The success that has attended the issue of the *Miniature Series of Painters* has led to the production of a similar series dealing with the lives and works of the great musicians. We have read with a very great deal of pleasure the first four volumes of this series, and heartily commend them to those of our readers who are interested in music, and they are many. Mozart is dealt with by Professor Prout, who has treated the fascinating details of Mozart's life in a most interesting manner, and discusses the special features of his music in a clear and succinct style. Our own musician, Sir Arthur Sullivan, forms the subject of the volume by Mr. Saxe Wyndham, to which a chapter is added by Mr. Ernest Ford. The writer shows great impartiality in discussing the question of Sullivan's devotion of his talents to light opera; but in reply to critics he urges that an artist should be allowed to direct his efforts to that kind of work which is most congenial to him, and in this he sees the secret of Sullivan's success, while *Ivanhoe*, *The Martyr of Antioch*, and *The Golden Legend* are ample proofs of his powers. Beethoven is dealt with by Mr. S. J. Shedlock, B.A., whose biography well sets out the testy nature of Beethoven's character. The works are classified and discussed with keen appreciation, although a recollection of the performance of the *Mass in D* at the Albert Hall some years ago makes us put a greater value on that work in spite of the great strain it puts the voices under. Modern French music is represented by Gounod in the volume by Mr. Henry Tolhurst. We do not share his high opinion of the *Redemption*, which seems overweighted with recitative.

ADAM AND CHARLES BLACK.

A Geography of Australasia, Oceania, and the East Indies. By Lionel W. Lyde, M.A. This book is similar in its general arrangements to the other school geographies by Mr. Lyde which we have already reviewed. There are no maps, as the writer, who is an expert teacher, wishes to encourage the use of the atlas. And there is much to be said in favour of his objection to a geography interleaved with maps, that "it is impracticable to have the book open in more than one place at a time."

The matter, as usual, contains the very kernel of the subject under well-arranged heads and sub-heads. These are so concise as to be a great help to the memory. As a suggestion for future editions, we think the sub-heads would be better designated by letters instead of figures, as on some of the pages the multiplicity of figures is confusing. Cause and effect are linked together directly and indirectly on every page. A student remembers that "Queensland is better suited to cattle than to sheep," because "both heat and rainfall increase towards the north-east."

We think the book is rather too bald in regard to political references. There is little or no indication that New South Wales, or Queensland, or the other colonies, belong to England, that the colonies are federated, and how. America's relation to the Philippines is not even hinted at. These omissions will make it difficult to answer such a question as No. 9 in the problem paper on page 69: "Compare the political and commercial value of the various colonies of Australasia." The appendix on page 68, relating to the antiquity of Australia, is a valuable addition to the book.

BLACKIE AND SON.

Brush-Drawing Cards: Sets I.-III. In the multiplicity of counsellors there may be wisdom, but the chances are there will be a good deal of confusion, and certainly the very wide range taken by guides and authorities concerning brushwork has not made the subject any more simple for teachers. The present set of cards, however, may well be taken as covering the ground, and setting an excellent standard so far as printed copies can do. They give examples, and suggest others, affording practice in flexible-point drawing, flat tinting, and colour contrast, sufficient for all the requirements of an ordinary school, and only need supplementing by the use of natural sprays and flowers.

English Passages for French Prose, for the Use of Middle Forms. Edited, with notes, by A. J. Perman, M.A., (Lond.), the County School, Merthyr-Tydvil. The idea of this work has been suggested by the requirements of the Junior and Senior Certificate Examinations of the Welsh Central Board. It consists of over a hundred short extracts, most of which have been translated from French, or adapted from English authors. We do not quite see how the use of this work is to fit itself into the scholar's ordinary studies in French, and the editor gives no assistance to the solution of the problem. The exercises do not appear to be graduated according to any particular plan, and there is no guarantee whatever that the earlier exercises, for instance, may not be dealing with peculiarities of construction quite outside the experience of the pupil. Translation into a foreign language is an essential and valuable part of the study of the language; but the work set in this direction must bear some necessary relation to and be co-ordinated with the work the pupil is doing in other departments of his study. Apart from these features, the editor's notes give assistance just where it is needed, and the book is well printed and bound.

WILLIAM BLACKWOOD AND SONS.

A First Latin Reader. With exercises, notes, and vocabulary. By K. P. Wilson, M.A. This book consists of a graduated accidence and syntax, with exercises for translation into English founded on what the pupil has already learned, and exercises for translation into Latin. The book leads the pupil from short, detached sentences up to continuous passages in simple sentences, and thence to passages from Latin authors where subordinate clauses are freely used. The plan of the book is good, but the information given on the syntax of Latin is somewhat too severely cut down.

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Etymological Dictionary of the English Language. (People's Edition.) A marvellous production for the price (1s.), copious, clearly printed, and well bound.

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duction deals with the life of the author, plot, and source of the play, characters of the leading men, etc.; and the notes are particularly good, because their chief aim is to make the student appreciate rather than criticise.

Commercial Geography of the World. By A. J. Herbertson, M.A., Ph.D. Dr. Herbertson has produced some very clever works on the subject of geography, and this issue of a sequel, so to call it, to his similar book on the British Isles is by no means lacking in high scholarship and general systematical arrangement. The chapters are based on lectures delivered in well-known educational places; and as they have been revised and brought up to date in their matter, they may be entirely depended upon as being suitable for the upper class children and commercial students. In seven chapters, covering some sixty pages, we get an epitome of general economic geography, while the remaining chapters are devoted to regional economic geography. There will be no difficulty at all to the student who may use the book as to where he may be able to find such and such information, for the author has adopted, in addition to the two main features of arrangement just indicated, a means whereby each subject is properly correlated, and in learning the facts there is no danger of his becoming a mere machine. The appendix, which contains statistical matter in a concise form, will prove valuable to many a politician at the present juncture. He who dabbles in the fiscal problem of the day will accord to the author his high appreciation for supplying him with information in so ready a way, and we feel confident that teachers of the subject will indeed be grateful to him for it. A most useful and complete index is added.

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Mankind in the Making. By H. G. Wells. This is in many ways a remarkable book. It is an attempt to deal with some of the most pressing problems of our modern civilisation—problems which are pressing because they threaten the very existence of that civilisation itself. The education of the future citizen is Mr. Wells's theme, taking education in the very broadest sense, as including all except heredity which goes to the making of a man. The treatment is always fresh and generally trenchant, for with the true journalistic instinct the writer knows that in order to be heard among the crowd it is often necessary to "cry aloud," and that nothing short of a double-barrelled superlative will awaken some readers to the fact that an adjective is being used. Many parts of the argument strike us as being eminently sane and commendably reticent, however, even where there must have been some temptation to go into fuller detail. This is particularly the case in the chapter on "The Cultivation of the Imagination," where sexual problems are treated of. There are other parts, it must be confessed, where we cannot extend the same praise to the author's execution, and where the book is notoriously unsatisfactory. In his treatment of Language, this weakness seems to be the result of mere want of knowledge, and need not be further insisted on. In dealing with Education, however, the faults cannot all be ascribed to ignorance, though some of them appear to spring from this source. In several places Mr. Wells has allowed himself to write with a regrettable bias as regards teachers—a bias which is not by any means unconscious, for he confesses to it somewhat in the manner which is vulgarly described by the phrase "with the tongue in the cheek." Any writer who is perfectly honest in making such a confession would take care to eliminate anything which he knew to be due to this bias, but Mr. Wells seems to suppose that the admission of unfairness is sufficient apology for the objectionable remarks which disfigure his book. His wholesale charge of ignorance against the teaching profession might be allowed to pass, as ignorance is a relative term, and the writer's standard of culture may be higher than his writings would lead one to suspect; but his charge of dishonesty is quite inexcusable as applied to a whole class, without qualification, and on grounds which are absurdly inadequate. It is not by such means that the "New Republic" will be hastened. The New Republican should surely have sense enough to know, and fairness enough to admit, that a man or a profession may differ from him on a point of grammar, and yet be entirely honest. There are many points in which Mr. Wells differs from recognised grammatical usage, and is guilty of solecisms in the use of English, but not for these would we venture to fix any stigma on his moral character. Is it too much for teachers to expect similar leniency of judgment from him?

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GALE AND POLDEN.

The Manual of Drill and Physical Exercises. By Thomas Chesterton. Of the many books that have been written on the subject of Physical Education, those from the pen of Mr. Chesterton are undoubtedly among the very best. In his *Manual of Physical Exercises*, Mr. Chesterton states that it contains "a carefully-selected course of exercises, compiled after a thorough study and testing of the various systems practised at home and abroad," thereby affirming that he is no advocate for the introduction of one system to the exclusion of all others. His arrangement of the exercises is excellent, and a logical sequence will be observed throughout. The explanation of the movements is presented in a very simple manner, and with the aid of numerous illustrations—all from photographs which give, of course, accurate positions—the teacher should find very little difficulty in grasping the intention of the respective exercises. The footnotes following each group, describing the parts of the body employed, lend additional interest. The exercises can be performed with or without dumb-bells, and to music, and it is important to note that "nothing is introduced which is impossible to be taught to an average class of children in a playground, whilst dressed in their ordinary clothing."

As swimming is now of such importance in schools, Mr. Chesterton has wisely included a preliminary drill for teaching the correct movements of the limbs. Slate and desk drill are also dealt with, and a table is given for the guidance of teachers in drawing up the syllabus of work for the classes. The chapter on rules for conducting the lessons will be found most useful, and mention must be made of an exceedingly instructive article upon the nature and objects of physical education, contributed by Dr. Roberts.

The Theory of Physical Education in Elementary Schools. By Thomas Chesterton. This forms a fitting companion to the *Manual of Physical Exercises*, and much useful information may be gathered from its pages. For example, in the chapter on spinal curvature attention is directed to faulty positions assumed by scholars, and to the serious results following from their continued repetition. Such matters too, as games, apparatus, musical drill, ventilation, are all skilfully discussed. To those desirous of obtaining a certificate in physical education—now generally recognised as an essential qualification of a teacher—Mr. Chesterton's book should be invaluable, for it embraces all that is necessary for the examination in theory. The syllabus for such examination, and the numerous samples of questions previously set, should prove extremely useful in this direction.

The Manual of Drill and Wand Exercises. By Thomas Chesterton. These exercises are intended by the author for the elder scholars who are fairly efficient in the exercises contained in the *Manual of Physical Exercises*, and to whom the use of the wand will afford variety, and thus dispel the monotony of the usual exercises. The movements are practically those to be found in the *Manual of Physical Exercises*, necessarily modified for the use of the wand. There is, therefore, little that is new to be learned. The explanation of the movements, as in the former work, is placed very clearly before the teacher, and the large number of excellent illustrations again forms a strong feature. Altogether this is an admirable compilation.

GALL AND INGLIS.

Archie's King. By Charlotte Elizabeth Baron. We opened this book with pleasurable recollections of Mrs. Baron's last book, *Rebels*. The Isle of Man is again the *locale* of the story, which concerns a small boy—quite a visionary—and his soul-consuming desire to see the King's coronation. An inopportune explosion of a firework blinds the boy temporarily, and he is prevented from seeing the King when he visits Manxland, but he managed to *touch* his Majesty. It is an interesting story, well told.

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The Teaching of Scientific Method, and other Papers on Education. By Henry E. Armstrong, LL.D., Ph.D., F.R.S. The publication, in a collected form, of the papers included in this volume may not be without value at the present critical juncture of educational affairs. These addresses, reports, and letters have appeared in the educational press from time to time during the past twenty years. They are not arranged chronologically: the earlier articles are didactic, and appeal to the general reader; the later are constructive, and appeal more to the specialist. We think well of Professor Armstrong's advocacy of the scientific method in schools, but we also think that there is more teaching by "doing" than he gives the teachers credit for. Assuredly there would be very much more if the classes were smaller; and we would fain believe that present-day teachers would not be horrified by his picture of a rationally-organised school of the future, provided the maximum number of scholars in a class was twenty. It is the large size of the classes which is responsible for wholesale demonstration rather than detailed investigation. There is, as one would expect in a collection of essays, a good deal of repetition of the same argument in order to bring home conviction to the reader; and whether the educationist is for sciences or scientific method, or for the humanities, he will find much refreshment and food for thought in the strong views and opinions of the author, which are so forcibly expressed in this book.

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It must not be supposed that the work is a mere compilation from German treatises. There are seventy-six pages of admirable introductory matter, dealing with the general question of the value of Herbartianism in education. Here the author justly lays great stress on the moral side of the question, and criticises previous writers in English for their neglect of this aspect. "*The moral significance of the system*," he tells us in italics, "*is well-nigh ignored*." Accordingly he gives us some capital remarks on the training of the will, and refers us to his *Student's Herbart* for a fuller statement of the moral implications of the system. No one can be more fully alive than Dr. Hayward to the dangers of misapplied Herbartianism. He has all the arguments at his finger-ends, and states them much better than they are usually stated by the opponents of the system. But he has an answer ready for them all. The "didactic materialism" objection he meets with the counter "didactic formalism." The "soft pedagogy" sneer he disposes of by showing that interest and pleasure do not necessarily coincide, and that instruction demands strenuous effort even when dealing with interesting subjects. With the concentration theory and the culture epochs theory Dr. Hayward is less concerned. They are the work of later writers. They are not of the essence of the Herbartian system, though in so far as they are educationally sound they owe their value to the application of essentially Herbartian principles. The great Herbartian paradox, "Stupid people cannot be virtuous," is excellently treated. The exact meaning of "stumpfsinnig" is difficult to make out, no doubt, from a mere dictionary, but by a process of comparison our author elaborates from the actual use of the word the meaning it must bear in the now famous saying.

The book is marked by a certain lack of system that may be attributed largely to the nature of the subject-matter. The author tells us that he had originally intended to translate large portions of the "critics," but that he soon found that this method would prove intolerably tedious to the ordinary reader; and it must be confessed that the synopses supplied are exactly what is required. Of the German critics, Hubatsch and Natorp are particularly well treated, though, on the whole, the section on Sallwürk shows Dr. Hayward at his best.

The book is one to be bought and studied by all who have any interest in the newer developments of education. Up till now Herbartian literature has been out of the reach of all who have not an excellent knowledge of German, coupled with access to books that are practically unknown on this side of the North Sea. Henceforth there is no excuse for the speaker or writer who deals ignorantly with Herbart. Dr. Hayward deserves the thanks of all interested in the progress of educational theory and practice. The book is not one of those depressing bits of destructive criticism that poor human nature takes an unhealthy delight in reading. The reader is led from Herbart through a circle of critics back to Herbart again. The motto of the whole book may be summed up in one of the author's happy phrases: "Herbart fascinates; his critics do not."

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